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AVIATION AND AIRCRAFT JOURNAL

Aerial View of Paris, Showing Place de la Concorde

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SPECIAL FEATURES

THE PRESIDENT ON AVIATION
WAR AERONAUTICAL APPROPRIATIONS—PART II
AIR SERVICE, AIR FORCE AND AIR POWER
SHALL WE ABOLISH THE BATTLESHIP?
THE NEED FOR A BUREAU OF NAVAL AERONAUTICS

THE GARDNER, MOFFAT CO., INC.
HIGHLAND, N. Y.
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INDEX TO CONTENTS

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The President on Aviation

THE President's message to Congress contains some extremely interesting references to aeronautics, as may be seen elsewhere in this issue. While opinions may differ as to some of the provisions advocated, the Presidential message, being the first authoritative pronouncement on aviation made by the new Administration, cannot but be read with the deepest attention by all who are concerned with the future of air navigation.

The advocates of a separate air department and of a single air force will undoubtedly be disappointed by the opening paragraph, where aviation is said to be "inseparable from either the Army or the Navy", although they—and the whole aeronautical world—will be relieved to read that the new Administration realizes that it "must, in the interest of national defense, encourage its development for military and civil purposes". The specific reference to the Air Mail Service as "an important initial step in the direction of commercial aviation" will in particular be hailed with satisfaction.

But the most gratifying part of the Presidential message dealing with aviation is beyond controversy that advocating the adoption of federal regulation of air navigation. The full importance of this recommendation can hardly be realized before federal air legislation is actually in being, for it is only by practical comparison that the great value of this measure will be appreciated. Of course, it is to be hoped that our national air legislation will follow the provisions of the International Air Convention as closely as is compatible with the rejection of the League of Nations, for what the President says about the hampering effect of independent and conflicting legislation on the part of various states of the Union applies with equal force to our relations with other countries, particularly Canada, Mexico and Cuba.

Since the new Administration does not, apparently, contemplate the creation of a single air force, it is but natural that the President should advocate the passage of the Hicks bill, which provides for a Bureau of Aeronautics in the Navy Department. The advantages of this measure are set forth elsewhere in this issue.

The final paragraph furnishes further cause for gratification as far as the development of commercial aviation is concerned. The forward looking policy of the Army Air Service of cooperating with various federal, state and municipal agencies in an endeavor to establish air routes and aerodromes is approved by the President, who suggests further developments along this line.

Altogether, the Presidential message holds out high hopes to the aeronautical world, despite the fact that it may not meet with unqualified approval insofar as the organization of our fighting air forces is concerned. Its great significance lies in that it is the first time that Washington has formulated something akin to an air policy. This is an excellent beginning. It is now the duty of the aeronautical world to keep the President's advisers informed of what constitute its essential needs, so that our new air policy may bear practical results.

Storage and Maintenance of Aircraft

IN the consideration of air transport almost all writers set down a large figure for depreciation, which, if allowed to stand unchallenged, constitutes a serious argument against commercial success. The experience on which such estimates are based is largely war experience, or else post-war experience under conditions far from ideal as regards storage and maintenance.

In the air an airplane not used for stunting undergoes much less severe treatment than an automobile. On the ground landing shocks may be severe at times, but with correct landing gear design and skilful piloting the wear and tear on frequent landings is continually decreasing. It therefore seems reasonable to expect that ware careful attention paid to storage and maintenance, depreciation of all types of aircraft might be reduced to reasonable limits.

The Navy appears to have given this subject very careful consideration and to have laid down comprehensive rules for storage and maintenance. These are simple and obvious for the most part. Hulls that have been in service should be thoroughly washed out with fresh water and dried. Floats should not be placed upon the floor, but on two blocks fitted under the bulkheads to allow ventilation underneath. Fuselages should be stored in storage racks. Fabric surfaces of airplanes should periodically be washed down with hard soap.

These and similar rules could be formulated by any capable ground engineer. Unfortunately, few are the seaplane stations where such rules exist, or if they exist, where the rules are faithfully followed. When federal air legislation will provide for licensed ground engineers, one of their most essential duties will be to pay due regard to this important aspect of commercial aviation.

Altitude Cockpits

WHEN considering altitude flight for commercial purposes, writers often lay considerable stress on the difficulties to be met in designing passenger cabins. Oxygen tanks, air tight walls and temperature and pressure regulators are stipulated among others and great difficulties are foreseen in developing this equipment.

Vane driven air compressors would probably obviate the use of oxygen tanks and a simple system of intake, exhaust and relief valves might take care of ventilation in the passenger cabin, which would have to be constructed with perhaps greater care to details than is usual. Exhaust gas heating, or electrical heating, comparatively easy to construct, would maintain a comfortable temperature in the cabin.

Taken altogether, the difficulties to be met in providing for commercial altitude flying appear to have been somewhat exaggerated.

The President on Aviation

From the Address to the 67th Congress, Apr. 12, 1921

Aviation is inseparable from either the Army or the Navy, and the government must, in the interests of national defense, encourage its development for military and civil purposes. The encouragement of the civil development of aeronautics is especially desirable as relieving the government largely of the expense of development and of maintenance of an industry, now almost entirely borne by the government through appropriations for the military, naval and postal air services. The Air Mail Service is an important initial step in the direction of commercial aviation.

It has become a pressing duty of the federal government to provide for the regulation of air navigation, otherwise independent and conflicting legislation will be enacted by the various states which will hamper the development of aviation. The National Advisory Committee for Aeronautics in a special report on this subject has recommended the establishment of a Bureau of Aeronautics in the Department of Commerce for the federal regulation of air navigation, which recommendation ought to have legislative approval.

I recommend the enactment of legislation establishing a Bureau of Aeronautics in the Navy department to centralize the control of naval activities in aeronautics and removing the restrictions on the personnel detailed to aviation in the Navy.

The Army Air Service should be continued as a coordinate combatant of the Army and its existing organization utilized in co-operation with other agencies of the government in the establishment of national transcontinental airways and in co-operation with the states in the establishment of local aerdromes and landing fields.

Air Service, Air Force, and Air Power

Prepared by Information Group, Air Service

In these days of controversy as to the relative merits of seacraft and aircraft, and as to whether the air forces should have a separate organization of their own such as the Army and Navy, or whether they should be divided piece-meal and assigned to those organizations which have use of them, there seems to be a general confusion existing as to exactly what is meant by air service, air force and air power. In an attempt to explain these various terms, it seems necessary to resort to the history of the late World War.

Observation Aviation

It will be remembered that when the first airplans actually flew military men were immediately interested in it because it represented to them a mobile elevated platform by means of which information could be obtained concerning the movements of an enemy whether on land or sea. Therefore, upon the outbreak of the World War, the few airplanes in existence were used purely for reconnaissance purposes. It did not occur to the military mind at this time that the airplane would become a powerful offensive weapon. Therefore, in the first few months of the war, a German pilot in the air would wave his hand in passing a French pilot and go on about his business, which was to get all available information relative to the movements of the French forces on the ground. This status persisted for some time and then some ingenious pilot got the idea that it would be a great help if he could shoot the enemy pilot while engaged in his mission and thereby prevent him from carrying back any information which he might gain. He attempted to do this with a pistol, rifle and shot gun with very poor success, due to the extreme difficulty of hitting an object moving at a high rate of speed which was also capable of quickly maneuvering out of range.

However, this idea was enough to start things, for the next step, which proved of extreme importance, was the mounting of machine guns capable of shooting through the propeller. This was destined to change the entire aspect of war as concerned the flying end of it. It did not take a military genius to figure out that an enemy airplane equipped with machine guns was capable of clearing the air of planes not so equipped. And thus the race for air supremacy was on.

Pursuit Aviation

Since the machine gun was fixed and fired through the propeller, in order to hit anything it was necessary to maneuver the whole airplane. In other words, instead of aiming the gun, the pilot aimed the airplane. Therefore, it now became necessary to design airplanes which could outmaneuver enemy planes, and by so doing, shoot them down. With this conception came the little pursuit plane, commonly and erroneously referred to as a scout plane, whose scope was to destroy as many enemy planes as possible. Its reason for being—in fact its very birth—was for the sole purpose of clearing the air of enemy planes so that its own observation planes could continue about their business as of old and to prevent the enemy observation from continuing theirs. Naturally, the German desire became that of getting more pursuit planes of superior performance on the front than could the Allies. The result was a pursuit plane extremely fast and maneuverable which carried only one man, and whose only function was to fight.

Therefore, at this stage we have two distinct branches of aviation. One branch concerns itself with aiding troops on the ground or on the water by seeking and obtaining for those troops information relative to the enemy, and by assisting in the adjustment of artillery fire on targets, which, due to its altitude, it can see when the surface troops can not. This branch is known as Observation, which, in turn, is divided into many specialized kinds of observation, such as Surveillance, Army Observation, and Corps Observation. However, the general object is always that which is mentioned above. The other branch concerns itself only with fighting in the air with a view of protecting its own observation machines and clearing the air of enemy fighting and observation machines so that its own observation machines may work freely over enemy territory or water.

Bombardment Aviation

These two branches constantly underwent improvement as to design and armament until a point was reached where it was realized that a modern airplane could carry considerable weight in addition to the personnel. This at once meant to the military mind a vehicle which could carry a certain amount of explosive to places beyond the range of artillery. And thus in 1918, we have the bombing plane coming into its own as an entirely new branch of aviation.

It is the function of Bombardment Aviation to destroy, by means of missiles containing either high explosives or gas, important centers of concentration behind the lines, or important manufacturing centers in the interior, or to attack bodies of troops marching along roads, with machine gun fire and fragmentation bombs. The possibilities of this branch during the late war were merely scratched. With the improvement of airplanes, greater weights can be carried and more effective bombs have been developed, whose terrific effect can be imagined when it is pointed out that in a 2,000 lb. bomb, 1,000 lb. is high explosive such as T.N.T. There are airplanes now easily capable of carrying a bomb of this size, and in the near future there will be planes capable of carrying three and four such bombs.

With the advent of the bombing plane, it was found necessary to increase the number of pursuit planes so that they could take on the additional burden of protecting the bombing planes as well as the observation planes. The bombing plane carrying a great load being at least a two-seater, is not so maneuverable or fast as a pursuit plane, and is therefore at its mercy.

Bombing, however, like pursuit, does not aid directly the forces on the ground or on the water. Its mission is to attack the reserves or to actually attack troops on the ground or ships on the water. In order that it may operate, it is necessary that the enemy pursuit be kept down or it will be subject to destruction from that enemy pursuit before it can drop its bombs effectively. Therefore, we have another branch of air force coming into being which concerns itself purely with air work and is not directly interested, as is observation, in the troops on the surface. This, in turn, is composed of specialties. For instance, it was found necessary to divide it into Night Bombardment and into Day Bombardment. One reason for the development of Night Bombardment was to protect it from pursuit attack under cover of darkness, as then it was possible to use a bigger airplane of slower speed capable of carrying much greater weight—a plane which would not last long in the day time in the neighborhood of enemy pursuit planes.

Ground Attack Aviation

During this period of development of the bombardment air forces, pursuit had not contented itself with simply shooting down enemy planes, but had found that, due to its mobility and great rate of speed, it could descend from altitudes and attack enemy troops on the ground with its machine guns, the fire from the ground being negligible as the fast plans could fire and get away before the forces on the ground could organize a defense against it. This was the forerunner of the latest development of aviation which did not take place until the closing days of the war and was called Attack.

The function of the Attack Aviation is to fly at extremely low altitudes and actually attack troops wherever they may be on the ground. In order to protect it from machine gun fire from the ground, the vulnerable parts of the plans and engine are protected with light armor. This branch of aviation, although in its infancy, has great prospect of development during the coming years. In addition to carrying very heavy armament (one type now in existence carries eight machine guns and one 37 mm. cannon), it also carries small fragmentation bombs which are very injurious to the morale of the troops. This new branch of aviation is also purely an air matter. It is vulnerable to attack of enemy pursuit and relies on surprise attack and flying at low altitude to escape this pursuit which is usually patrolling at a high altitude.

"Air Service" versus "Air Force".

Therefore, from the above it can be seen that the name "Air Service", which was originally applied to aviation, was applied because at that early time the only work of the airplane was observation work as outlined previously in this paper. Its duty was simply service to the troops on the ground and it had an other function. However, we see that in addition to this air service, arms of aviation have been developed which are purely air force, namely, Pursuit, Bombardment, and Attack, whose element is the air; who are not concerned with movements of enemy troops on the ground or directing artillery fire, and whose function is purely an air function. The name "Air Service" is an unfortunate heritage and a misnomer. It would be as logical to insist that the army be called "Artillery" or "Infantry", each of which is a component of the Army.

In the event of war, the difference between air service and air force becomes even more sharply defined. The Air Service would *be* mobilized at the same rate as would its divisions, corps, or armies, but the Air Force should be ready to operate on " D Day" to prevent hostile air raids on our important centers, and at the same time to attack the centers of the enemy with a view to delaying his mobilization and preparations. Without such an air force, if the attacking nation had one, strong and efficient, our main centers could *be* put completely out of action with gas and high explosives. This interference might become so serious as to prevent our mobilization and result in almost complete helplessness. Again, the Air Service depends directly on the size of the army mobilized. The Air Force is limited in size by that of the hostile air force and our ability to produce the necessary equipment and personnel.

What "Air Power" Means

Having traced the development of Air Force, it is desired to treat briefly the subject of Air Power. Air Power may be defined as the application of air forces, and air forces can be mobilized and concentrated at any desired point infinitely quicker than can units on the surface, either troops or ships. Air forces move without reference to railroads or roads at a rate about five times as great as the average movement of ships and of troop trains. Therefore, by means of this air force, power can be quickly applied to any point of our coast within a very limited time after information is received that such a point is threatened. Like every other power, however, it must be directed by one head. There are no frontiers or coast lines in the air, and it makes no difference whether this air force fights over the sea or over the land, the personnel is trained in the same manner and the tactics utilized are identical. Again, it is only the Observation aviation or Air Service which stays and acts directly with troops or ships.

In closing this paper, it is desired to ask if any thinking person would advocate doing away with our navy on the supposition that if we should have was our plants could turn out the necessary battleships with their auxiliaries in time to be of any use. Such a proposition is quite as sound as is the one that advocates that the equipment for an air force can then be built. It takes three years to develop a first class fighting, bombing or attack plane, a limit of time which compares with that necessary to develop a fighting naval vessel. The navy in the future must share with the Air Force the honor of holding the first line of defense, as the navy possesses no oceans within itself to stop an air attack. Therefore, why not face the facts and act accordingly?

It must be appreciated, in considering Air Service and Air Force, that the Air Service is really a part of and works directly with the Army organization. Therefore, Air Service aviation need not be ready for action until the Army itself is ready for action, inasmuch as it cannot be used by or work with the Army Units at the front until those units reach the front. It is therefore apparent that the Air Service can be allowed the same length of time to prepare for service at the front as it takes the Army to prepare for and reach the front.

On the other hand, it will *be* necessary for the Air Force to begin operations not only on the day, but on the minute that war is declared. In case there should be was between the United States and a bordering country, the side which put its air force organizations into the air first, attained air ascendency and maintained it, would decidedly have the advantage; it could carry on depredating expeditions against important centers in the enemy territory with much greater effect than if it were necessary to carry on these expeditions in the face of overwhelming forces of enemy aviation. In other words, the Air Force, like the Navy, is a first line of defense and must be ready to act the minute was is declared, whereas the Air Service is a service like the Signal Corps and necessity for its presence is not established until the army with which it operates takes its place at the front.

What $598,090,781 Bought in War Aviation

Details Now Available of Achievements of Our Aviators and Cost of War Air Effort Here and Abroad.

The final official account of the work of our air service at home and abroad is now available. In last week's issue a detailed statement was published of the War Aviation appropriation showing $582,562,781 has been returned to the United States Treasury. The detailed cost of our War Aviation during 1917 and 1918 is also now made public for the first time through the compilation of liquidation reports by AVIATION AND AIRCRAFT JOURNAL. The official statement follows.

Activities at the Front

"American flying officers, with the American armies, with the Royal Air Force, with the Independent Air Force, with the French and with the Italians destroyed 781 airplanes and 73 balloons, a total of 854 enemy aircraft, actually confirmed; it being impossible to furnish records of non-confirmed successes of which there were many. The American losses in airplanes and balloons to the enemy were 289 airplanes and 48 balloons, a total American loss of 337. The superiority of the American Air Service is shown by the confirmation of almost three times as many enemy airplanes shot down as American airplanes lost to the enemy, and nearly twice as many balloons. The actual battle fatalities of the entire U. S. Air Service personnel with the American, British, French and Italian armies for the entire war, was 227. It is not possible, of course, to know the exact number of fatalities of the enemy incurred in their loss to the Americans of 854 airplanes and balloons, but it may be assumed that the majority of these airplane losses represent fatalities.

"American airplane pilots spent 35,747 hours over the lines, participated in 150 bombing raids on the western front, dropping 255,000 pounds of explosive. The 37 squadrons in operation in the first and second American armies whose flying hours for pilots are given herein, flew 966 hours per squadron, although these units had been at the front varying periods from 1 day to 7 months. The American hours nearly equal the hours flown by the Belgians during the entire war. The British squadrons flew 1292 hours per squadron, on all fronts, active and inactive. One thousand six hundred and forty-two balloon ascensions were made by American flying officers in the Zone of Advance, with a total of 3111 hours. These balloons made 319 artillery adjustments and were attacked 89 times by enemy aircraft. One hundred and sixteen parachute drops were made from balloons. The aerial observers employed in photography made 17,854 photographs of enemy positions and distributed for interpretation and other purposes 585,000 prints. The activities of the Air Service in training and at the front were carried on from 73 airdromes in the Zone of Advance alone. Nearly 600 American and foreign decorations were awarded to Air Service officers and soldiers up to May 1, 1918, and the list has been increased since.

Personnel with the Armies

"On the day of the Armistice, there were 45 American squadrons and 23 balloon companies assigned to American armies and to the French, Italian and British Air Forces. Twelve of these squadrons had American made DH-4 airplanes. There had been sent 1230 pilots and 749 observers to the American Zone of Advance. There were actually at the American front on Armistice day 767 pilots and 481 observers, as well as radio and other specialists, both flying and non-flying, and 172 pilots and 20 observers at the front with the allied air forces, not to mention other personnel. Other flying officers were, of course, in reserve and in training. Thirty-five balloon companies were in the A.E.F. on November 11, 1918."

Flying Training

"During the war period there were commissioned in the Air Service, both flying and non-flying, a total of 20,708, of which 12,449, over 60 per cent were trained for flying duty as air plane pilots, balloon pilots, airplane and balloon observers, airplane gunners, bombardiers, etc. In this training, for the fiscal years 1917-18 only, not to the end of training even, there were flown in the United States 000,606 *airplane* hours, with a total of 331 fatalities, a ratio of 1 09, and .346 fatalities per 1,000 hours flown in 1917-18 respectively. In the A.E.F. there were flown a total of 193,193 hours in training with 100 fatalities for the entire period of training, a ratio of one fatality to 1143 hours flying. **Of the airplanes received in the A.E.F. 2948 were sent to training centers and 2925 to the Zone of Advance to December 31, 1918."**

Production and Purchase A. E. F.

"Of the 45 American squadrons on Armistice date, 33 squadrons were equipped with foreign made airplanes, in addition to which individuals operating with the Italian, French and British forces used machines of these countries respectively. Twelve squadrons were operating or equipping with American DH-4's, and equipment was on hand, both foreign and American, for further squadrons so they could complete training, organize and get to the front. **On Armistice day there were 740 airplanes actually with the American armies, of which 196 were American DH-4's, with 502 in reserve.** One thousand four hundred and forty three DH 4's were received in France, sufficient to supply the unit equipment of 24 'planes, without wastage, for 2 squadrons. Including automobiles, trucks, motorcycles, etc, there were purchased by the Air Service 3065 pieces of transportation equipment. Of the 602 hangars on hand, 414 were from the United States, and 388 from France and England."

"One thousand eight hundred and eighty-eight airplanes had been outfitted with radio equipment; 1444 airplanes had been armed. There were 9232 machine guns on hand, besides those installed in airplanes."

"There had been received in France to December 31 1918, 6639 airplanes (4886 from France, 291 from England, 19 from Italy, and 1443 from the United States). Seventy-seven balloons had been sent to the balloon companies on the front, 57 of which were American made, with others in reserve."

Above is the official record of the achievements of our Air Service with the A.E.F. and at home. Volumes have and many more will be written of the heroic work of our pilots. But every time our activities in the air during the war are mentioned, the public recalls the oft repeated statement by misinformed persons "that the United States spent a billion and a quarter dollars for aviation and got nothing for its money".

In last week's AVIATION AND AIRCRAFT JOURNAL there was presented for the first time the fact that $582,562,781 of the wartime aviation appropriations remained unspent and has been returned to the treasury. The cost to the taxpayers was therefore, according to the present figures after the Liquidation Boards had finally reported, $617,489,977.

It is practically impossible to find out the exact cost of every item that was purchased, as so many different departments bought for the Air Service at such varying prices. What everyone who looks back at our aircraft activities does want to know is what the government received for the vast sum. It is believed, that this information is gathered together in a condensed report and presented for the first time in the following tables.

First, are shown the expenditures in the United States. From this tabulation, it will be seen that out of $478,489,977 spent in the United States only $113,721,043.39 was spent for airplanes. The engines being ordered in such large quantities have to be considered separately as so many more were constructed than airplanes. The sixty-one American fields, schools and depots are shown in detailed cost. As will be seen from the huge quantities of materials ordered it would be a gigantic accounting task to secure the exact amount spent for each item therefore they are grouped under the total of $11,817,220.11.

Below is given the cost of our Air Service in the United States in detail from figures compiled by AVIATION AND AIRCRAFT JOURNAL from official reports.

Air Service Expenditures in United States

9,742	Airplanes from Aero Industry	$84,784,165 18	
2,600	Airplanes from Auto and Kindred Industries	19,845,827 89	
3,182	Airplanes from Miscellaneous	9,173,950 84	$113,721,043 91
15,524			
	(Airplanes considered ex without engines)		
14,765	Engines from Aero Industry	101,725,366 64	
24,958	Engines from Auto and Kindred Industries	132,102,818 63	
5,134	Engines from Miscellaneous	11,010,774 69	244,855,162 90
41,953	(Includes all engines in or out of airplanes)		
244	Balloons and 1 Airship from Aero Industries	4,754,356 96	
5,889	Balloons from Auto Industry	5,294,750 91	
31,575	Balloons from Miscellaneous	100,162 25	7,169,269 01
41,947			
	(Includes free and observation passenger balloons, and pilot, supply, target and propaganda balloons and 1 airship.)		
90	Flying Schools and Fields	$9,587,422 74	
5	Balloon Schools	2,910,496 01	
1	Aerial Photo School	1,200 00	
1	Radio School and Laboratory	486,350 00	
1	Aerial Gunnery School	380,000 00	
1	Mechanics School	159,000 00	
8	Warehouses and depots	5,114,041 87	
9	Engine Repair Depots	1,082,120 00	
2	Concentration Camps	3,400,700 96	
5	Acceptance Parks and Experiment Station	641,584 50	
9	Sundry Stations	470,154 94	69,727,918 47
91			
	(Above figures for Construction)		
	Rentals for flying fields, schools, depots, rights of way, buildings, warehouses, wharves, etc (22,912 acres, not including floor space in offices, etc		$ 709,890 72
	Hellines experiments and plants, Nos. 1, 2, and 3 (Army share)		926,459 00
982,426	Air Pressure and Gasoline Gauges, Air Speed Indicators, Altimeters Clocks Compasses etc		
98,555	Machine Guns		
19,789	Synchronizing Devices		
15,129	Flexible Ring 'A' Gun Mounts		
44,672	Gun Light Parts		
20,076	Gun Yokes, Controls, Light Mounts		
227,595	Dummy and Loaded Bombs		
11,980	Mark I Bomb Sights		
246	Barlow Heavy Bomb Releases		
10,213	Bomb Releases and Parts		
14,542	Flares and Releases		
1,051	Cameras		
465	Enlarging Lanterns		
1,589	Camera Guns		
1,159	Photo Cradles		
3,968	Steel and Canvas Hangars		41,817,220.11
3,422	Tons Ferro Silicon and Caustic Soda		
172,800	Hydrogen Cylinders		
256	Balloon Winches		
3,910,000	ft. Balloon Cable		
15,873,000	yds Airplane Fabric		
7,888,000	yds. Balloon Fabric		
7,259,000	yds Cotton Tape		
976,000	gals Acetate Dope		
86,000	gals. Nitrate Dope		
343,240	Miscellaneous Clothing		
42,424	Propellers		
83,159,721	gals Oil		
249,612,095	gals Gasoline		
24,000,000	cu ft Hydrogen Gas		
197,838,000	bd ft. Lumber from Mfrs. and other Miscellaneous Items		
			$478,489,977.00

Total Expenditures in U. S. $478,489,977.00

The figures showing the purchases abroad for the A.E.F. are the first that have ever been presented giving costs and items. The $139,000,000 was allotted to so many different projects that it has taken two years to reach a settlement with foreign governments and companies. As the latest figures show, $19,940,769.28 was spent for 5,220 airplanes. For airplane spare parts $7,490,114.23 was used. Hangars, tents and other shelters cost $8,228,119.38.

There were thirty-one American fields, depots and parks constructed and equipped overseas. As will be seen in the figures below it is impossible even now to segregate all the items as has been done in the United States accounting, as the figures are probably scattered in so many places that only the sums expended by the different offices are yet obtainable.

The miscellaneous expenditures in France, England, Italy and other countries total over $60,000,000.

Air Service Expenditures for A. E. F.

4,879	Airplanes from France	16,253,623 82	
283	Airplanes from England	1,210,419 90	
68	Airplanes from Italy	485,271 16	
5,228	Airplanes		$19,949,769.28
6,400	Engines from France	15,903,822 11	
219	Engines from England	1,304,110 90	
444	Engines from Italy	2,961,883.23	
7,063			22,559,821.64
	Airplane Spare Parts from France	7,297,451 85	
	Airplane Spare Parts from England	192,815 14	
	Airplane Spare Parts from Italy	50,397 22	7,490,114 23
	Engine Spare Parts from France	7,347,464.97	
	Engine Spare Parts from England	122,925 23	
	Engine Spare Parts from Italy	51,230.00	7,721,620 19
	Instruments from France and Italy		469,153 92
	Propellers from France and Italy		240,270 10
	Squadron Equipment from France and Italy		2,210,687 77
	60 Balloons, 60 Winches, Equipment and Supplies from France		3,100,000 50
	Armament from France for 2054 Airplanes	759,990 00	
	Armament from Italy, Misc.	9,118 15	769,098.15
	Hangars, Tents, Huts, Canvas, etc.		
	From France	1,881,330.28	
	From England	6,406,786.09	8,288,116.36
	Radio Equipment from France		1,052,845 11
	Photo Equipment and Supplies		987,719 23
	Photo Transportation Equipment from France (75 Vehicles)		599,560.37
	Dope ($489 gals.) and Cellulose Acetate (17 tons) from France and England		176,009.55
	Special Clothing from France and Italy		28,868 98
	Signal Equipment Supplies from France		919,497 10
	Castor Oil, Gasoline, etc. from England		1,328,675 15
	Construction of —		
11	Flying and Balloon Schools	$ 3,286,974 68	
7	Airdromes	2,344,298 25	
9	Depots	1,977,890 92	
	Miscellaneous Projects	119,725.49	
1	Warehouse	1,030,460 48	
1	Acceptance Park	9,147,199 27	
1	Assembly Plant		
1	Replacement and Concentration Barracks	167,940 19	
1	Test Field	112 888 84	$16,182,274.47
31			
	Miscellaneous —		
	Includes—motor transportation, small tools, machinery, shop equipment, steel products, mineral supplies and equipment for general operations, shells, tool kits, boxes, cases, etc.		
	France	29,809,324 22	
	England	1,697,176 66	
	Italy	12,497,484 84	
	Switzerland	147,831 19	
	Spain	356,976 71	43,208,794 92
	Other Miscellaneous Items		19,700 773 98
	Total Expenditures for A.E.F.		$139,000 953.98

Recapitulation

Expenditures in U. S.	**$478,489,977.00**
Expenditures in A. E. F.	**139,000,000.00**
Total War Aviation Expenditures	**617,409,977.00**
Actual receipts for Materials sold	**19,399,196.00**
Net Cost of War Aviation	**598,090,781.00**

Shall We Abolish the Battleship?

By Lieut. Comdr. J. P. Norfleet, U. S. N.

It has been stated and printed in the public press time and time again, that aircraft has rendered the battleship obsolete. One of the chief arguments of the advocates of the airplane superiority is the question of expense in building battleships. Obviously, this is merely pandering to the general desire throughout the country to reduce the cost of government, thereby reducing the individual taxpayer's effort. It would appear that we are concerned with legislative affairs only when our pocketbook is endangered.

The object of this discussion is to show that, far from decreasing the expense of the Navy, to abandon our present program and go in for all air defense will entail much greater expense. A few examples will show this to be a fact.

For instance, Brigadier General William Mitchell advocates building 1000 planes for the price of one battleship. Assuming the possibility of this, let us consider the relative after costs or upkeep of the two types of craft.

	INITIAL COST	CREW	ANNUAL PAY	LIFE	ANNUAL UPKEEP
Battleship	$40,000,000	1,200	720,000	25 yrs.	1,000,000
1000 Bombing Planes	40,000,000	10,000	10,000,000	3 yrs.	10,000,000

Here we see that our 1000 airplanes, which will at best be obsolete or destroyed in service after 3 years, will have cost us about $100,000,000 and will require replacement at equal or greater cost, whereas the battleship at present and contemplated peacetime rates of development will be available for the first line for at least 20 years. Moreover, the planes will have cost as much as two battleships within three years and will be of no further value.

To forestall questioning the figures in the above table a few words of explanation are necessary. The average pay per individual for the crew of an airplane is figured at almost double that of a battleship, due to the much higher percentage of officers and the increased pay in aviation. The upkeep of the bombing planes is placed at $10,000 per plane per year. This is a most modest estimate, as the life of an engine is from only 100 to 200 hours, and the cost of two replacement engines alone would amount to $10,000. However, many of these planes would be in reserve and thereby reduce upkeep to a certain extent, but not enough to alter the figures as given. The estimate of three years for the useful life of a plane is also optimistic as types become obsolete very quickly with active development such as the above program would call for.

Moreover, in the above table no effort is made to consider the overhead costs due to the establishments which will be necessary on shore for the housing and upkeep of these craft. These facilities already exist in the Navy for ships of all kinds, but would have to be developed at tremendous expense to provide for the enlargement of the aircraft program on a grand scale.

If we scrap our battleships, must we have a substitute? The proponents of the "scrap the lot" policy predict a future war where our aircraft carriers of 35 knots speed will go out and annihilate the enemy's battleship force without ever coming in range of his guns. Let us admit that they can do this and figure on how much it will cost us to get these ships.

ESTIMATED COST OF 16 CARRIERS

CONTRACT COST	NO. OF SHIPS	TOTAL
30,000,000	16	480,000,000

Does anyone at present delude himself with the idea that the Congress of the United States will enter into a building program involving the immediate expenditure of half a billion?

Granting for the sake of argument that sixteen aircraft carriers would be superior in fighting value to an equal number of battleships, a survey of world conditions discloses little likelihood of immediate effort on the part of any nation to place its main reliance on this type as a capital ship. The matter of expense is here paramount. The development of the carrier is bound to come, but it is equally sure that it will come in the slow process of time and that all battleships now building will serve their usual lifetime in their old role of the capital ship. The future will see navies and armies relying more and more upon aircraft, but what the stimulus of war failed to develop can be but a slow evolution in times of peace.

It may be generally stated that aviation reached its fullest development in Germany, and yet no British capital ship was ever successfully bombed by a German aircraft. If this is as feasible a proposition, one would have thought that the German Navy would have attempted to neutralize the difference between the British and their fleet in such a manner. The answer is that the difficulties involved were too great to justify the effort. Those same difficulties exist today despite the statements of aviation enthusiasts to the contrary.

No one having a knowledge of the capabilities of aircraft is inclined to question the statement that it is possible to destroy a battleship or at least render it unmanageable by bombing from the air, provided the air service is allowed to stipulate the conditions of the problem. It is no feat for several hundred planes to fly over a lone ship within 300 miles of the coast and drop sufficient bombs so that numerous hits must be necessarily made. However, unfortunately, an enemy in wartime is not so obliging. No admiral would have the temerity to attack a fortified coast without being prepared to ward off attacks by air. He would carry his own aircraft as well as all the other units of a properly constituted fleet, except in the event of sporadic raids which would be undertaken when conditions did not permit of aircraft attack. For instance, German aircraft was of no aid against the English Navy either during the raid at Zeebrugge or at Ostend. This was not due to lack of aircraft, as the Germans had numerous airdromes along the Flemish Coast. Also, it does not mean that the existence of aircraft was ignored by the attackers.

The writer does not wish to create the impression that aircraft are not of great value to the Navy, or to minimize their future possibilities. It is simply necessary to cut your garment according to your cloth and to show the folly of loose talk about a sky filled with planes without first reckoning on the cost of such a program. The Navy, as it exists today, is the work of years, not weeks or months, and even if the entire Navy were agreed that the battleship had outlived its usefulness, the tremendous expense involved would prevent anything but a gradual replacement by other types. Of course no such view is held and battleships in all navies worthy of the name form the nucleus about which a fleet is constituted. Aircraft carriers are a part of this fleet, as necessary as are submarines or destroyers, and must form a part of all future naval plans, both strategic and tactical, but so long as the foreign commerce of a country is waterborne, command of the surface will be paramount and will also be necessary in order to attain and hold command of the air.

Aerial Tournament at Holdredge, Neb.

An aerial tournament which promises to be the biggest flying event the West has yet seen will be held at Holdredge, Neb., on May 5 to 7 by the Central Aircraft Co., of that city. The whole program is intended to create and maintain in the public interest for aviation and to display the various types of airplanes now being manufactured for commercial and sport purposes.

The Holdredge Commercial Club will furnish gasoline and oil free of charge to all ships on the field on May 5, 6 and 7, and it will furthermore provide all these aircraft with a full tank for flying home.

A big indoor carnival organized by the American Legion will be held throughout the evenings of these days and a general good time is planned for all those who attend.

A large number of participants is expected at the meeting.

Air Service Adopts Location Marker

The Air Service has gone a step further in its comprehensive program of providing a uniform system for marking the air routes of the United States until national air legislation will come into being.

As a complement to the 100-ft. circle landing field marker previously adopted—which has been described more than once in these columns—the Air Service has now adopted the location marker which is illustrated herewith. It should be clearly understood that *this location marker does not supersede the 100-ft. circle* which the Air Service hopes to have placed on all flying fields approved by the Government. The location marker is merely an identification sign which answers the purpose of enabling an airman to determine his position with respect to the nearest town and for this reason it is to be

LOCATION MARKER LAID OUT AT BOLLING FIELD, WASHINGTON, D. C.

placed along the railroad track on the right hand side entering a town. It might therefore easily appear near a town in which there is no landing field, but a reference to his aeronautical map would promptly enable the aviator to identify the town in question and thus his location.

As the location marker hereafter specified shows the latitude and longitude of the point of the ground so marked, and provides for sufficient identification, the Air Service has abandoned its original intention of numbering the various flying fields approved. Another reason for this latter decision is due to the fact that the International Air Navigation Convention, to which the United States is expected eventually to become a party, provides for the marking of landing fields by latitude and longitude. The full provisions for the marking of air routes as contained in the International Convention take up too much space to be reproduced here, but those interested will find them in the 1921 year book of the Manufacturers Aircraft Association.

Following are the specifications of the location marker adopted by the Air Service:—

SPECIFICATIONS FOR THE AIR SERVICE LOCATION MARKER

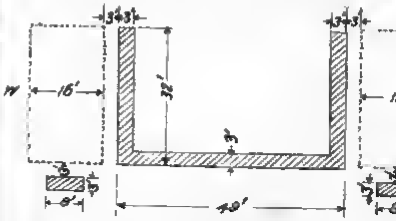
The attached drawing shows the diagram, identification numbers and dimensions of same.

The material should consist of heavy stones (cobblestones suggested), and must be whitewashed frequently so that the diagram will be very distinguishable from the air. Whenever the diagram is placed on the flying field the earth must be dug out so that the stones will be flush with the surface of the ground.

The railroad right of way or vacant lot adjacent to the railroad would be the logical location for the diagram. In the case of one railroad the diagram will be placed on the right hand side of the track, and on each side of the town so that it can be read by the flier from his right as he approaches the town. Two railroads would necessitate the laying out of four diagrams. In other words, there should be two diagrams for each railroad, so that a flier, following any railroad into the city, can locate himself immediately.

In addition to the above diagrams, one should also be placed on the landing field if there is one. This, of course, is the ideal, but if it is impractical at this time to construct more than one of these diagrams, preference should be given to the north or east side of the town.

Before attempting to understand the following explanation, it is suggested that the reader procure a map showing the lines of latitude and longitude and location of his town. The open sided rectangle represents the lower or upper half of the rectangle formed on the map by the lines of latitude and



WORKING DIAGRAM OF THE LOCATION MARKER ADOPTED BY THE AIR SERVICE

longitude. The dot inside represents the town and its relative location on the map.

The numbers indicate the latitude and longitude of the south and west sides of this rectangle. For example, if a town is in the rectangle whose south and west sides are formed by the lines 39 deg. latitude, and 80 deg. longitude respectively, then the relative diagram will have number 9 on the left and 0 on the right, the latitude number always being placed on the left and the longitude number on the right. The last number in each case is considered sufficient, because the points 29 and 30 or 49 and 90 are approximately 600 miles away on either side, and the aerial navigator will not be confused as to their identity for he generally knows within much less than 600 miles where he is.

A town being in the upper or lower half of the rectangle is indicated accordingly, and the dot is placed relative to its location on the map.

The balance of the drawing is self-explanatory. The name of the town is laid out at the top or bottom of the rectangle, depending on the case in hand. Letters should not be less than 4 ft. in height, for they must be discernible at a great distance.

Flying Activities in New England

Although flying activities in the New England states are of a limited nature if measured by the achievements of other sections of the country, it is gratifying to learn that there is at least one New England aircraft firm which has been operating with success ever since the Armistice. This firm, the Eastern Aircraft Corp., of South Boston, Mass., started operation on a small scale at the close of the war. Today it owns a factory of 22,000 sq. ft. surface area and a fleet of twelve airplanes and two seaplanes. The company operates in all branches of aviation, being equipped to give instruction in ground work at the factory, and flying instruction on both land and water aircraft.

"Who's Who in American Aeronautics"

Patrick Nelson Lynch Bellinger

BELLINGER, PATRICK NELSON LYNCH, Lt Comdr U S N born, Cheraw, S. C, Oct, 9, 1885 son of Carnot Bellinger and Eleanor (Lynch) Bellinger

Educated Naval Academy 1907

Professional U S. Navy, Cadet to Lt. Commander, 1907 Won highest final merit in Navy In charge 12 in gun, 1910, Submarine duty, 1912

Aeronautical Activities U S Naval Academy (Aviation duty) (Nov 26 1912 to Dec 31, 1912) Guantanamo, Cuba (Aviation duty) (Jan 10, 1913 Mar 15, 1913) Detailed as flyer of heavier-than aircraft by Secretary of the Navy, March 9, 1913 U S. Naval Academy (Aviation duty) (March 24 1913-Jan 12 1914) U S. S. Mississippi Aeronautic ship Pensacola Fla (Aviation duty) (Jan 21 1914 July 21 1914) In charge Aeroplane Section at Vera Cruz, Mexico during seizure and occupation of Vera Cruz, 1914 During which period piloted aeroplane for 40 consecutive days—making flights over enemy territory Aeroplane was struck in three places by enemy's fire during one scouting flight over enemy territory U S S North Carolina (Ship and Aviation duties) (July 25 1914 to Dec 4, 1914) Pensacola Fla Naval Aeronautic Station (Aviation duty) (Jan 12 1915—March 11 1916) In charge special Aviation Section cooperating with Army Experimental Mortar Firing at Fortress Monroe, Va (July 25 1915 to Aug 25 1915) U S S North Carolina (In charge Aviation Section) (March 11 1916 Dec 18, 1916) Pensacola Fla Naval Aeronautic Station (Aviation Department) (Dec 22 1916-Nov 20 1917) Temporary duty selecting suitable site for naval air station resulting in Miami Fla (Aug 9 1917 Oct 2 1917) Commanding Officer Naval Air Station Hampton Roads Va (Nov 20 1917 March 17 1918) Temporary duty in connection with selection of two Air Stations in Nova Scotia (May 6, 1918 May 20 1918) Navy Department Operations Trans-Atlantic Flight Section (March 20 1919-April 22, 1919) Temporary duty on U S S Barney selecting starting point for Trans-Atlantic Flight (March 22 April 12 1919) Commanding Officer U S Seaplane NC 1 Trans-Atlantic Flight (May 3, 1919 June 19 1919) In charge Material Division, Naval Aviation (July 9 1919

Flying Rating Navy Air Pilot No 4 Jan 21, 1915 Naval Aviator March 22 1915

War Service Navy Air Pilot No 4 Jan 21, 1915 Naval Aviator March 22 1915 Received decoration from Portuguese Government— Comendador-Torre Espada Navy Cross

Member New York Yacht Club Aero Club of America, Seawanaka Yacht Club Army and Navy Club (Wash), University Club (Philadelphia), Catholic Club (N Y) American Legion

Present Occupation Office of Director of Naval Aviation Washington

Address Navy Dept Washington D C

Norman S. Goetz

GOETZ NORMAN S., Lawyer born, New York City March 7 1887, son of Samuel Goetz and Julia Goetz

Educated Public schools New York B A 1908 Columbia College, LL B 1909 Columbia Law School

Professional Practiced law 1909 to date (Except during war) member law firm Riegelman Carns, Leventritt and Goetz, 120 Broadway, N Y

Aeronautical Activities Enlisted Private 1st class, Dec 7 1917 promoted 2d Lt. March 14 1918 promoted 1st Lt Oct. 11 1918 promoted Capt Air Service Reserve, April 11 1919

War Service Adjutant, Love Field Dallas Tex

Member Aero Club of America Air Service Association

Present Occupation Lawyer

Address 120 Broadway New York home, 105 E. 91st St. New York City

Michael F. Davis

DAVIS MICHAEL F., Major Air Service born New Richmond Ohio, March 29 1894 son of Robert A Davis and Frances M Davis.

Educated Public Schools New Richmond Ohio 1915 U S Military Academy West Point

Aeronautical Activities Aviation Section Signal Corps Sept 1917 Continuous service to date Balloon student at present

Flying Rating Airplane Pilot.

Member Army and Navy Club (Wash)

Present Occupation Balloon Student, Ross Field Calif

Address Chief of Air Service, Washington D C home, Ross Field, Arcadia, Calif

Edgar Staley Gorrell

GORRELL EDGAR STALEY Engineer born, Baltimore, Md Feb 3 1891 son of Charles Edgar Gorrell and Pamelia Stevenson (Smith) Gorrell.

Educated Public schools of Baltimore Md Baltimore City College, U S. Military Academy Mass Inst. of Tech Master of Science in Aeronautical Engineering at M. I. T in 1917

Professional Officer U S Army 1912 1920 Sales Extension Manager, Nordyke Marmon Co., Indianapolis Ind

Aeronautical Activities Began flying 1914, flew in California to 1914 1915 San Antonio Tex 1916 in American Punitive Expedition in Mexico chasing Villa in 1916 In A E F 1917 1918 1919 Chief of Staff Air Service, A E F Aeronautical Engineer

Flying Rating Pilot, F A I license in 1915 Junior Military Aviator 1915, Military Aviator, 1917

War Honors Distinguished Service Medal 1919 British Distinguished Service Order 1919, French Legion of Honor 1919

Books Army Air Service Publications

Member Aero Club of America

Present Occupation Sales Extension Manager Nordyke Marmon Co

Address Nordyke Marmon Co Indianapolis Ind

Earle Ovington

OVINGTON EARLE Aviator born Chicago Ill Dec 20 1879 son of Edward Ovington and Mary Ovington married, Adelaide Alexander, April 19 1912

Educated Irving School Tarrytown-on-Hudson, Mass Inst of Tech Boston

Professional President, Ovington Mfg Co., 1906-1909 President, Ovington Motor Co 1908 1917

Aeronautical Activities Exhibition flying Dec 20 1910 to Nov 30, 1911 President, Curtiss Flying Station Atlantic City N J during the war first aviator to fly over Boston first aviator to fly over States of Connecticut New Hampshire and Rhode Island, winner John R McLean Cross country trophy ($2,500 cup) appointed by Postmaster General Hitchcock the first U S. Aerial Mail Carrier 1911

Flying Rating French "brevet" No 440

Member Aero Club of America Press Club American Inst of Electrical Engineers

Present Occupation Builder of patented "One Room" bungalows

Address Santa Barbara, Calif

Albert Cushing Read

READ, ALBERT CUSHING Commander, U S N born Lyme N H March 29 1887 son of Joseph B Read and Mary E (Backer) Read married Bess A. Burdine Jan 30 1919

Educated Naval Academy Annapolis, Md

Professional Graduated Naval Academy Class of 1907 Commissioned Ensign, Sept 1908 Served in Navy since that date now, rank of Commander received Sept 23, 1919

Aeronautical Activities Took up training in aviation July 1915 various duties ashore and afloat in connection with aviation commanded NC-4 on Transatlantic Flight May 1919 now Commanding U S S Harding Tender in Air Force of Atlantic Fleet.

Flying Rating Naval Aviator

War Honors Comendador Torre e Espada (Portugal) Royal Air Force Cross (British) Distinguished Service Medal (U S)

Books Co-author with Comdrs Westervelt and Richardson "Triumph of the NC's"

Member Aero Club of America New York Yacht Club Seawanhaka Corinthian Yacht Club Chevy Chase (Md) Army and Navy Club (Wash)

Present Occupation Commanding officer U S S Harding

Address Navy Dept., home, 1925 Newton St N W, Washington, D C

Kelly Monroe Turner

TURNER KELLY MONROE Manufacturer born, Pimento, Ind July 19 1859 son of Rev J M Turner and Louise (Sluer) Turner, married Alice Brown 1885

Educated Country schools

Professional Inventor and Manufacturer of the Dictograph, Acousticon and Aviaphone

Aeronautical Activities Since 1905 experimental work on voice transmission instruments

Member Pres and Organizer Aero Club of Southern California Aero Club of America

Present Occupation Retired

Address 5703 Sunset Boulevard, Hollywood, Los Angeles, Calif

Glenn L. Martin

MARTIN, GLENN L., Airplane Manufacturer, born Macksburg Iowa Jan 17 1886 son of Clarence Y Martin and Minta (De Long) Martin.

Educated Salina (Kans) public and High School Kansas Wesleyan University

Professional Automobile business before 1909 Since then constructor of airplanes

Aeronautical Activities Began in 1907 to build gliders 1908 designed and built pusher type airplane and taught self to fly 1909 established one of the first airplane factories in the U S Flew regularly during 1909—1911 constructed airplanes of various types including monoplanes and water aircraft In order to secure funds for further development of designs gave many exhibition flights to various parts of U S and Canada qualified for F A I Aviators Certificate Aug 10 1911 incorporated Glenn L Martin Company at Santa Anna, Calif 1911 moved factory to Los Angeles, 1912 built airplanes for exhibition flying and sport use until 1913 when first order was received from War Department for Model T T, which was later adopted by the Army for training purposes 1914 1916 produced several new models for U S Army and built for the governments of Holland and Netherlands East Indies twenty-four airplanes (these were models "T A" "S" and "R") 1917, factory was employing about 155 men constructing aircraft merged interests with Wright Company, resulting in the Wright-Martin Aircraft Corporation at New York 1916 withdrew from Wright-Martin Co and organized Glenn L Martin Co of Cleveland, designed and built Martin Bombers, the first American designed airplane for Liberty engines new plant with 72000 sq ft of floor space completed at Cleveland 1919 Company to 400 men working at 52 different trades producing Martin Bombers for U S Army Navy and Post Office, flying field adjoins factory

Flying Rating Taught self to fly 1908 Federal Aviation Certificate No 56 Expert Aviators Certificate No 2 Aero Club of America

War Service Builder of airplanes for Army and Navy

Honors Medal for over ocean flight from Newport to Catalina (Calif) 1912

Member Aero Club of America, Union Club (Cleveland) Ex-Vice-President, S A E Los Angeles Athletic Club

Present Occupation President, Glenn L Martin Co

Address 16800 St Clair St Home 2717 Euclid Boulevard Cleveland, O

James Blackstone Taylor, Jr

TAYLOR JAMES BLACKSTONE JR Executive born New York City Sept 23 1897 son of James B Taylor, Sr and Lydia (Thorne) Taylor married, Aileen B Sedgewick Nov 24 1917

Educated Pomfret School, Pomfret Conn Princeton University

Professional Assistant to President of Upressit Products Corp formerly U S Metal Cap and Seal Co 1918 to present time

Aeronautical Activities Joined U S Naval Air Service in 1917 trained at Bayshore L I was instructor in advanced flying at Miami Fla., and later test pilot for Bureau of Operations while test pilot for Planning Section of Operations, tested the following Loening "Cat" Kitten, Loening monoplane Curtiss Wasp triplane, "F A Fighter" and the "Davis" gun carrier and the Vought "V E 10" flying boat and the Sperry Messenger", has flown over fifty different types of machines, both land and water

Flying Rating Expert Aviator No 121 Aero Club License No 222 Naval Aviator No 437

War Service U S Naval Air Service, July 1917 on inactive duty Feb 1919, rank of Lt U S N R F

Member Aero Club of America Flying Club Metropolitan Society of Automotive Engineers

Present Occupation Manufacturer

Address 103-107 West 13th St., home, 471 Park Avenue, New York City

Caleb S. Bragg

BRAGG CALEB S., Sportsman born Cincinnati Ohio, Nov 23 1885 son of Caius C Bragg and Eugenia (Maforl) Bragg

Educated B A. 1908 Yale

Aeronautical Activities Started flying in 1915 as sportsman and continued to date. Director of Flying McCook Field, Dayton, Ohio Winner of Curtiss Marine Flying Trophy 1917

War Service Captain, Air Service stationed at McCook Field

Member Chairman, Contest Committee, Aero Club of America

Address 21 W 28 St., New York City

Wesley Leland Smith

SMITH WESLEY LELAND, Pilot, U S. Air Mail Service born, Los Banos, Calif., Jan 9, 1893 son of Oscar B Smith and Amy D Smith

Educated Grammar and High Schools in State of California, Bach. of Science, College of Electrical Engineering, University of Calif, 1915

Professional Public School Teacher, State of Calif 1915 Nov 1917, School Teacher and Military Drill Master, Riverdale Country School, Riverdale-on Hudson, N Y., Jan to May 1918

Aeronautical Activities Helped build Flying Boat in shape at University of California in 1916 Flying Cadet School of Military Aeronautics, Berkeley Calif Jan 14 to March 25, 1918, Flying Cadet, Rockwell Field, San Diego, Calif, March 28 to May 29 1918, Machine gun instructor, Camp Dick, Dallas, Tex., June 1 to July 28 1918, flying instructor, Payne Field West Point Miss., Aug 1 to Oct. 15, 1919, exhibition flights and passenger flights, Boston, Mass and Hartford, Conn., June to Oct. 1919 Pilot, U S. Air Mail Service N Y—Wash Route, Nov 11, 1919—May 15, 1920 N Y—Cleveland Route, May 15 1920—to date, only man living who has made a N Y—Cleveland round trip in one day Dec 3 1920 flew Cleveland to Mineola in DH4a with mail 423 miles in 2 hr 48 min average speed 151 m p h, (record) Dec 29 1920 fifth in seniority among mail pilots

Flying Rating Reserve Military Aviator U S. Army, May 22 1918 Airplane Pilot, F A I Aero Club of America License No 2599 Oct 22, 1918

War Service U S. Army, Nov 2, 1917 to Dec 27 1918, Commissioned 2nd Lt., R.M.A. U S Air Service, May 22 1918

Member Aero Club of America

Present Occupation Pilot, U S Air Mail Service

Address Hazlehurst Field, Hempstead, L I home 11 East 38th St, New York

Barton Kyle Yount

YOUNT, BARTON KYLE Major Air Service born Troy Ohio, Jan 18, 1884 son of Noah Yount and Ivy K Yount married, Mildred A. Parker Sept. 29 1914

Educated Public Schools, Troy, Ohio Ohio State University 1902-1903 U S. Military Academy, 1907

Professional 2nd Lt 27th Inf 1907 1st Lt May 1913 Capt 15th Inf Oct 1916 Major Signal Corps, Aug 1917 Lt. Col, Air Service, Aug 1918 Major, Air Service, July 1920

Aeronautical Activities Commanding Officer School of Military Aeronautics, Austin Tex Oct 1918 to Sept. 1919 Commanding Officer, Camp Dick, Dallas, Tex Sept 1919 to Nov 1919 Office Chief of Air Service, Washington, D C., Nov 1919 to Feb 1921 under flying instruction Rockwell Field Coronado, Calif Feb 1920 to July 1920 Commanding Officer March Field Calif July 20 1920 to date

Flying Rating Airplane Pilot

Member Aero Club of Southern California

Present Occupation Commanding Officer March Field Riverside Calif

Address March Field, Riverside, Calif

Elliott Daland

DALAND, ELLIOT Aeronautical Engineer born Brookline, Mass., Jan. 9, 1889 son of Tucker Daland and Emily J (Elliot) Daland married Katherine M Brown Sept 1910

Educated Private Schools, Volkmann's, Boston Clayne Newport Hackley Tarrytown A B 1909 Harvard Graduate School of Applied Science 1910 Aeronautical Engineer, Mass. Inst. of Tech 1918

Professional With Sullivan Machinery Co., Claremont N H, 1910-1911 American Gas Tool Co., Chicago Ill, 1911-1919, Engineer on experimental gas press.

Aeronautical Activities Standard Aero Corp, 1918-1919 Curtiss Engineering Corp. 1920 Huff Daland & Co., 1920-1921

Present Occupation Huff, Daland Co., airplane contractors

Address Huff Daland & Co home 818 Green St. Ogdensburg, N Y

Edgar Nathaniel Gott

GOTT EDGAR NATHANIEL Aeronautical Executive born Detroit Mich., May 2 1887 son of Edward A Gott and Stephanie (Ortman) Gott.

Educated Detroit University School B S. 1909 University of Michigan

Professional Asst Supt Griffin Wheel Co, Pullman Ill, 1909-1911 Resident Engineer, Griffin Wheel Co Tacoma, Wash 1911 1919 V P and General Mgr Boeing Airplane Co., 1915 to date

Member Aero Club of the Northwest Seattle University Club

Present Occupation Vice President and General Manager Boeing Airplane Co

Address Boeing Airplane Co., Seattle, Wash.; home, 2808 Tenth Ave. North Seattle, Wash.

William F. Pearson

PEARSON, WILLIAM F., Major, Air Service, born Washington, Ohio, Nov 1, 1880, son of William H Pearson and Marietta A (Arnold) Pearson, married, Eliza E Wadhams, Feb. 22 1888

Educated Private Grammar School High School, Delaware, Ohio Ohio Wesleyan University

Professional Private Corporal and Sergeant, 28th Battery Field Artillery, U S A., Feb 22 1902 to Oct. 4, 1904 2nd Lt. 25th Inf., Oct. 5 1904 transferred to 9th Inf., May 9 1905 transferred to 23d Inf April 26, 1910, promoted First Lieut., March 11, 1911 transferred to 9th Inf Jan 1 1915 promoted Captain, July 1, 1916 transferred to 41st Inf., June 9, 1917 appointed Major, Signal Corps, Aug 9 1917 appointed Lt. Col. Signal Corps, Feb 26, 1918, appointed Col, Air Service, May 24 1919, Major, Air Service Regular Army July 1 1920

Aeronautical Activities Detailed with Signal Corps Aug. 5 1917 assigned to duty as Commanding Officer School of Military Aeronautics, University of Illinois, Oct 1 1917 assigned to duty, General Supply Depot, San Antonio, Tex, Aug 21 1918 Office Chief of Air Service, Dec 28 1918 Administrative Executive, Air Service, continuously from Jan 9, 1919 to date

Member Phi Kappa Psi Fraternity Army and Navy Club (Wash) Lambs Club (N Y)

Present Occupation Administrative Executive, Office Chief of Air Service

Address Munitions Bldg, home, 1719 21st St., Washington, D C

Jacques Michael Swaab

SWAAB JACQUES MICHAEL Executive born, Philadelphia, April 21 1894 son of Mayer M Swaab Jr and Etta (Stein) Swaab

Educated Clagborn school Philadelphia Central High School Sachs Collegiate Institute N Y 1916 B S University of Pennsylvania.

Professional Representative Frank H. Fleer Corp., Phila Pa

Aeronautical Activities Started to fly in Aug 1917

Flying Rating Junior Military Aviator

War Honors Cited for distinguished and exceptional gallantry at Metz, France on Sept. 8 1918; cited for distinguished and exceptional gallantry at Thiaucourt on Oct 31 1918 Distinguished Service Cross, Aug 29 1920 American Ace, credited with 10 airplane victories.

Member Mercantile Club Phila., Pa Aero Club of Pennsylvania Aero Club of America.

Present Occupation President, Royal Blue Cigar Stores, Inc

Address 1219 Flatiron Bldg home No 1 West 68th St., N Y

George Hume Peabody

PEABODY GEORGE HUME Major Air Service born Shinglehouse Pa., Nov 24, 1893 son of Albert Francis Peabody and Anna (Johnston) Peabody married, Helen MacShane, June 15, 1915

Educated Grammar and High Schools U S. Military Academy, 1915

Professional Cadet U S M.A. June 14, 1911 to June 11 1915 2d Lt., 2d Cavalry, June 12 1915 1st Lt July 1, 1916 Captain, July 9, 1917 Aviation Section and Air Service Sept. 1, 1917 to date Major Air Service July 2 1920

Aeronautical Activities Student, Rockwell Field, Sept 1 1917 to Dec 13 1917 Officer in Charge Flying, Eberts Field March-June 1918 Officer in Charge Training, March Field, Dec 1918 to date also on duty for short time at Ellington Field M I T Boston and Wilbur Wright Field, Dayton Ohio and O D A S

Flying Rating Junior Military Aviator, Dec 19 1917 Airplane Pilot June 1920

Present Occupation Officer in Charge of Training Air Service Pilots School March Field, Calif

Address March Field Calif, home 502 E 92nd St. Cheyenne Wyo

Charles Jerome Edwards

EDWARDS CHARLES JEROME Executive, born Arcadia Wayne Co N Y May 9 1868 son of Lora Edwards and Mary Edwards, married, Edith Wendell Aug 26, 1890

Educated Public schools

Professional Life Insurance, Mgr Equitable Life Assurance Society, March 15, 1888 Vice President, N Y Plate Glass Ins. Co. Vice President, Manhattan Bridge Three Cent Railway Line Director of Mechanics Bank of Brooklyn and Roosevelt Savings Bank City of New York Ins Co Morris Plan Co

Aeronautical Activities Charter Member Aero Club of America Nov 1905 Treasurer, Nov 1906 to 1919 Vice President, 1912 1921

Member President, Brooklyn Club President, Rotary Club of Brooklyn, 1916-1920, Bankers Club Lawyers Club

Present Occupation Manager Equitable Life Assurance Society (Brooklyn)

Address 204 Montague St., home, 399a, Grand Ave., Brooklyn N Y

Walter R. Weaver

WEAVER, WALTER R., Major, Air Service, born, Charleston S C. February 23, 1885 son of Erasmus Morgan Weaver and Elizabeth (Holmes) Weaver married, Elizabeth Ker Johnson Sept. 23, 1911

Educated Prince School, Boston, Mass. High School, Galveston, Tex., Virginia Military Institute U S Military Academy

Professional 2nd Lieut., Feb 14, 1908, 1st Lieut 1915, Capt 1916 Major, (temp.) 1917, Aviation Section Signal Corps Major, Air Service, 1920

Aeronautical Activities Wilbur Wright Field, Command of Cadets in Charge Ground Instruction organized Mechanics School, Wilbur Wright Field Command of and Executive Officer, Wilbur Wright Field, 1917, organized and commanded Air Service Mechanics School St Paul, Minn., 1918 Chief Mechanics Instruction, Office Director Air Service Chief Engine and Plane Maintenance, Office of Air Service 1919 1920 Acting Chief Property Division, Office Chief Air Service, 1920

Flying Rating Primary Flying, March Field, Advance Flying (bombing), Kelly Field Airplane Pilot

Member Army and Navy Club (Wash) Army and Navy Club (P I) Sigma Alpha Epsilon

Present Occupation Acting Chief Property Division Air Service

Address Air Service, Washington, D C

Harold Fowler McCormick

McCORMICK, HAROLD FOWLER Manufacturer born Chicago, Ill, May 2 1872 son of Cyrus Hall McCormick and Nettie (Fowler) McCormick married Edith Rockefeller Nov 26, 1895

Educated University School of Chicago, Browning School of New York City, 1890-1891 A. B 1895 Princeton University

Professional International Harvester Co., became President Dec 29 1918, Trustee University of Chicago McCormick Theological Seminary, Chicago Orchestral Assn; Director, First National Bank of Chicago, Chicago Grand Opera Assn

Aeronautical Activities Vice President and Member Board of Directors of Aero Club of America, President of Aviation Meet in Chicago in 1911

Books "From My Experiences Concerning Aviation"

Member Aero Club of America Aero Club of Illinois

Present Occupation President, International Harvester Co.

Address 606 S Michigan Ave, home, 1000 Lake Shore Drive Chicago, Ill.

John Hamilton Jouett

JOUETT JOHN HAMILTON, Major Air Service born San Francisco Calif, May 14 1892, son of Cavalier Hamilton Jouett and Mary Wright (Hooper) Jouett, married, Fredrika Mason Kellog Feb 1 1919

Educated Public Schools Pennsylvania Military Academy 1914, U S Military Academy West Point, N Y

Professional 2d Lieut. C A. C. June 12, 1914 to July 1, 1916 1st Lieut. C A C to April 4, 1917 1st Lieut Aviation Section, Signal Corps to July 24 1917 Major Air Service to May 9, 1919 Lt Col Air Service to June 30 1920

Aeronautical Activities Instructor U S. Balloon School Fort Omaha Neb., April 1 1917 to Sept 15, 1917 Airship pilot R A F May 1919 Director and Instructor Airship School Langley Field Va July 1919 to Dec 1920

Flying Rating Balloon Observer Airship pilot; Junior Military Aviator

War Service A E F C O Balloon Group IV Corps, July and Aug 1918, C. O Balloon Group V Corps, Sept and Oct, 1918 C O Balloon Wing, 2d Army Nov 1918 to Feb 1919

Present Occupation Major Air Service

Address Brooks Field, Texas

Henry Black Clagett

CLAGETT HENRY BLACK Major Air Service born Ft Wayne Mich, Dec. 19 1884 son of John Rogier Clagett and Cornelia M (Black) Clagett.

Educated Public schools Cheyenne, Wyo, Denver Colo Cincinnati, Ohio 1909 U S. Military Academy

Professional U S Army since July 31, 1902

Aeronautical Activities Kelly Field, Tex., Oct 1917 to May 1918 Rockwell Field May 1918 to Aug 1918 Kelly Field Sept 1918 to Jan 1919 Supervisor S. W District, Jan to April 1919 Dallas-Boston flight, April to Sept. 1919 Kelly Field, Sept. to Dec 1919, S. E Dept. and 4th Corps Area since Dec 1919

Flying Rating Junior Military Aviator, 1919; 1920 Airplane Pilot

Member Aero Club of America

Present Occupation Air Officer 4 Corps Area.

Address Ft. McPherson, Ga.

Col. Shaughnessy, 2nd Ass't Postmaster General

Col. E H. Shaughnessy appointed on Apr. 11 by President Harding as Second Assistant Postmaster General is a transportation expert. He has always resided in Chicago with the exception of several years spent at smaller cities in Illinois in connection with railway work. He entered the service of the Chicago & North-Western Railway in July, 1899, as a telegrapher and remained continuously in the service of that railroad until May 28, 1917, when leave of absence was granted to enter the military service. During his connection with this railroad system he was promoted and served in many operating capacities, being last engaged as its trainmaster with office at Chicago.

During the month of May, 1917, the War Department called on the railroads entering Chicago quickly to mobilize a regiment of railwaymen for urgent service with the French forces The railroads acted immediately calling for volunteers. Colonel Shaughnessy applied for service in any capacity He was immediately relieved from railroad duties and asked to assist Colonel Langfitt, afterwards Major General Langfitt, in recruiting the regiment which afterwards became the 13th Engineers. Colonel Shaughnessy worked as a civilian in this capacity until May 28, 1917, when he was commissioned as a First Lieutenant and immediately assumed command of company "E" retaining command as First Lieutenant and as Captain until June 28, 1918

The 13th Engineers sailed from the United States July 27, hurried through England and France and after a short period of training were attached to the Second French Army, relieving the 7th French Engineers, taking over the operation of an extremely important network of military railroad in the Verdun sector The regiment remained in the Verdun sector until well after the armistice, being one of the very few units that remained under French command during the entire time

Upon arrival in the Verdun Sector Colonel Shaughnessy was made Railway Executive Officer in charge of railway operation remaining in this assignment until June 28, 1918, when upon request of General W W Atterbury he was detached from the regiment and assigned to duty with the Transportation Corps of the A E F, serving successively as General Superintendent, Assistant General Manager, General Manager and Acting Deputy Director General of Transportation, of the Advance Section, (the active front) during the time being advanced in rank to Major on September 7, 1918, and Lieutenant-Colonel February 26, 1919 During this period at the beginning of the organization of the transportation corps in France Colonel Shaughnessy in collaboration with French military and civilian railwaymen prepared a joint French English book of rules for railway operation which was used by the American forces during the entire period of hostilities and which afterwards proved to be of invaluable assistance in overcoming the great difficulties experienced in utilizing in joint railroad operation railwaymen who had no common language

For service in France Colonel Shaughnessy was awarded the Distinguished Service Medal with the following citation (War Department G. O. No. 95 July 26, 1919)

"Edward Henry Shaughnessy, Lieutenant Colonel, Transportation Corps, United States Army For exceptionally meritorious and distinguished services. Serving successively as General Superintendent, General Manager and Acting Deputy Director General of Transportation, by his energy, zeal, and able management he rendered services of the highest type to the Transportation Corps of the American Expeditionary Forces. In the performance of his manifold duties he constantly displayed marked enthusiasm, originality and sound judgment."

In addition he was decorated by the President of the French Republic on Sept. 24, 1919, with the Legion of Honor, Order of the Black Star, for distinguished service rendered to the French forces.

He was especially commended by the General Staff for conspicuous service during critical operations at Chateau-Thierry and also during the St. Mihiel and Meuse-Argonne offensives.

On January 17, 1920, Colonel Shaughnessy was commissioned a full Colonel in the Officers Reserve Corps, Engineer Section, and was further honored in War Department G O No 74, Dec. 16, 1920, by being included in the initial General Staff eligible list which is a selected group of officers who by virtue of meritorious service are declared to be competent for General Staff duty without taking the prescribed course of training that has been outlined as necessary as a result of the late war experience.

Colonel Shaughnessy returned to the United States on Sept. 26, 1919, resuming service with the Chicago and Northwestern Railway and later resigning therefrom to become Assistant Director, Division of Transportation, of the American Petroleum Institute, where he is now located.

Colonel Shaughnessy is a member of the Executive Committee, Fidelity (New York Elks) Post No. 712, American Legion, of the New York Post, Military Order of the World War; of the New York Post, Society American Military Engineers, of the 13th Engineers Officers Club; and of the American Association of Railroad Superintendents

Colonel Shaughnessy is Republican in politics but has never been active in political affairs He was born Oct 28, 1882, and is, therefore, 38 years old.

As Second Assistant Postmaster General, Colonel Shaughnessy has charge of the Air Mail Service.

Calculated Performance of Airplane Equipped with Supercharging Engines

N.A.C.A. Report No 101

In part 1 of this report are presented the theoretical performance curves of an airplane motor equipped with a supercharging compressor Means for estimating the temperature rise in the compressor are outlined. Since the compressor will be designed for a definite normal pressure ratio, the gross power output under normal conditions is easily computed when the intake temperature is known. In the case of a gear-driven compressor, the net power is obtained by subtracting the power absorbed by the compressor from the gross power For use in determining the size and power absorption of the compressor needed in a given case, a formula for the variation of the volumetric efficiency of the motor with intake temperature and exhaust pressure is derived

A graphical method is outlined whereby performance curves for either type of motor-compressor unit at all speeds and altitudes may be laid out with the aid of assumed compressor characteristics. Comparative performance curves for Liberty motor operating with a turbine-driven compressor, a gear-driven compressor, and without supercharging, are derived in an illustrative calculation

Part 2 of this report presents an estimation of the performance curves of an airplane fitted with a supercharging motor. If the heat leak from gas turbine and exhaust pipes to the water jackets is prevented, and the cooling system is kept under constant pressure, an additional radiator equipment should be required when a supercharging compressor is fitted to an airplane engine.

In an illustrative example horizontal flight speed and maximum climbing speed curves are worked out for the Lepere two-seater fighter when equipped with supercharging and non-supercharging engines, and with both fixed and variable pitch propellers.

A supercharging installation suitable for commercial use is described, and it is shown that with the aid of the compressor a great saving in fuel and a considerable increase in carrying capacity can be effected simultaneously.

In an appendix the writer derives a theoretical formula for the correction of the thrust coefficient of an airscrew to offset the added resistance of the airplane due to the slip-stream effect.

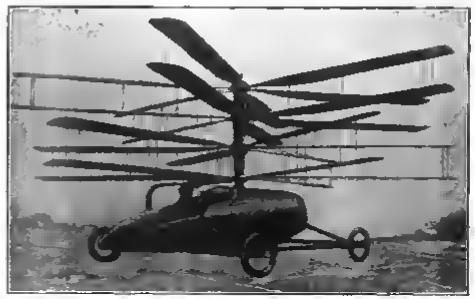
A copy of Report No. 101 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

The Pescara Helicopter

A new helicopter which is attracting a good deal of attention in Europe is the machine shown herewith in imaginary flight. It was built by the Marquis R. Pateras Pescara, of Spain

In May, 1918, M. R. Pescara built a first type of helicopter model for trials. In July, 1919, he tried a first type of a parachute helicopter In November, 1919, his inventive activities were encouraged by the French Air Service authorities Since this date the inventor has built a second helicopter

The second machine, which was assembled at Barcelona, is very simple. It is a racing autocar, of orthodox design, in which the track and the wheel-base of the four wheels are very great. At the center of gravity is fitted a vertical shaft with two co-axial propellers of 20 ft. diameter These two concentric lifting screws are mounted one above the other turning in opposite directions Each screw has six biplane blades, constructed very much like an ordinary biplane with struts and wire bracing The engine driving the revolving wings develops 55 hp and the propellers turn at the maximum rate of 200 r p m, the circumferential speed being approximately 200 ft per second



Wash Drawing Showing the General Arrangement of the Pescara Helicopter

The power transmission consists essentially of two gear shafts, one horizontal and the other vertical The horizontal shaft is driven from the engine by means of an automobile type clutch At the opposite end of this shaft there is a herring-bone bevel gear which meshes in with a horizontal drive wheel bolted onto the vertical or main drive shaft. This shaft operates the two propellers by means of a differential which is controllable from the pilot's seat. The pilot can, by moving a lever, speed up or slow down either propeller, or make them turn at the same speed, which fact, the inventor claims, will afford a wide range of control in the horizontal plane.

The height of the helicopter is 9 ft. It weighs 1500 lb and the estimated horizontal speed is about 90 m p h.

The important feature claimed by the inventor of this machine is ability to land slowly with engine stopped Apparently, the screws are tilted to give them a good gliding angle when revolving freely, and then, just before coming to ground, the angle is increased to that of maximum lift. The whole principle of this apparatus rests on the control arrangement, which allows each of the blades of the propellers at whatever points of rotation, different inclinations. As a result the center of support may, at the will of the pilot, be shifted to the right or the left, behind or in front, or to any intermediate position.

Theoretically, the piloting of this aircraft does not present any difficulties. By shifting a lever the blades of each propeller are given maximum incidence and the helicopter ascends. When the pilot wants to land, he reduces the incidence of the propellers in the same way The inventor claims that the vertical speed on landing will be 20 m. per second.

The first official trials of this machine took place on Feb. 2 last, at Barcelona, Spain, before a commission of the technical section of the French air service headed by Captain Huguet. Although the machine did not succeed in leaving the ground, the thrust developed by the propellers at the maximum designed speed of 200 r.p.m. is reported to have been 20 lb per horsepower. As the conditions laid down by the French Air Service for the purchase of the Pescara helicopter called for a minimum thrust of 13 lb per horsepower, the trial favorably impressed the French mission, Captain Huguet expressing the opinion that before the end of the year a helicopter would achieve a flight in a closed circuit. Another reason for the confidence shown by the French commission is said to be the excellent showing made by the mast, the gears and the propellers, none of which disclosed structural weakness during the lengthy tests on the ground.

In this connection the following excerpt from the report made by the French commission is significant:—

"We have found the Pescara helicopter admirably constructed and we are certain that we shall be able to carry out all the tests intended and required to show the qualities of such a machine. Those which we have made to date gave us full confidence of ultimate success. It is with the greatest assurance that we shall continue the experiments, but we do not wish to attempt any actual flights yet. These will probably take place next month.

"What we now can state is that the construction of the Pescara helicopter is so satisfactory that the machine gives promise of much greater success than any that have hitherto been designed."

While the trials of this machine are proceeding, the inventor has completed the drawings of a third type, which will be propelled by a 110 hp. Le Rhone engine and is to weigh about 1,300 lb

Naval Airship Locates Lost Torpedo

At the naval air station, San Diego, California, there was recently given a demonstration of the extraordinary efficiency of the non-rigid type of airship when searching the surface of the water for small floating objects, together with the cooperation between aircraft and surface craft in such problems.

The non-rigid airship B-18 participated in the search for a torpedo lost from a vessel during battle practice After a vigilant search of the lower bay off San Diego for about two hours and a half, the nose of the torpedo was sighted, the body of the torpedo being submerged. A smoke bomb was dropped within a few feet of the torpedo, denoting its location to a searching party on board a torpedo boat destroyer. The searching boat immediately responded to the call and recovered the torpedo, thus saving several thousands of dollars for the Government.

The ability of airships to hover over definite locations adds to their value in search problems of this nature.

Charles H. Keel Opens Office

Charles H Keel, who has been engaged in the practice of patent law for the past ten years, being at one time in charge of the Washington office of the General Electric Co.'s patent department, and more recently patent counsel for the Curtiss Aeroplane and Motor Corp., announces the opening of an office at 280 Broadway, New York, for the general practice of patent, trade-mark and copyright law.

The Breguet Leviathan Type X X

By E. H. Lemonon*

In the beginning of the return to peace conditions, many French and foreign engineers designed large aircraft, in which the numerous engines, often scattered over the wing structure, could neither be repaired nor properly attended to in mid-air. In general, the existence of these mastodons of the air was brief, for no sooner were they built than they proved themselves to be very poor flying machines when tried out. They were fragile, because too heavy; slow, because of their high head resistance, and not properly maneuverable, because of their great inertia caused by widely separated masses such as engines, tanks, etc.

As Andre Herbemont, the eminent engineer of the Blériot Spad Co., has remarked "you cannot make a giant airplane by simply adding a lot of horse power to a lot of square feet of supporting surface", with elaborate coach work and a spacious saloon. It must not be the work of an interior decorator but that of a capable engineer. You must first and foremost think of the efficiency in flight which the machine will have.

It might seem to the reader who will peruse these lines that we are an enemy of multi-engined machines. Yes, that is true, when it is a question of "Christmas tree" machines, of a compromise type poorly thought out. Let us, for instance, establish a comparison between a single-engined biplane X, of 700 hp. and a tri-motored biplane Y, of 750 hp., both exhibited at our last Aeronautical Exposition.†

The first machine was of medium size (span 53 ft., length 34 ft. 6 in.), while the second was very much larger (span 83 ft., length 62 ft. 3 in.). The biplane X carrying 790 gal. of gasoline could cover distances of 3100 miles in one hop (such as Paris—New York) at a speed of 161 m.p.h. The speed of the biplane Y was only 99.5 m.p.h., and in spite of the fact that its horsepower was greater than that of the single-engined machine, its radius of action would be only 1750 miles at the most in case all of the useful load were put into fuel. This multi-engined machine with its enormous head resistance, is not superior to the single-engined machine from the point of view of endurance, quite the contrary. On the other hand, from the view point of safety, it might have a decided advantage, possibly in the event of one of its engines giving out it might be able to continue its flight on a more or less horizontal trajectory and even reach its destination. In order to combine these two advantages—"cleanness" a characteristic of single-engined machines, and "safety" hitherto a characteristic of multi-engined machines only, it would seem very seductive to abandon the idea of a single engine which can be entirely put out of action in case of a breakdown, and substitute therefor a careful grouping of several power elements, working independently, but driving a single propeller.

The "ace plus ultra" solution would be to have one of these power elements held in reserve and by some automatic mechanism brought into play when one of the working elements broke down. Thus we can conceive of a perfectly appointed engine room permitting the possibility of changing a complete power element in actual flight without in any way disturbing or delaying the progress of the cruise.

We shall see, shortly, how the engineers of the Louis Breguet Aviation Works have succeeded in creating a power group of 850 hp. total, which seems to be a step in the direction indicated above, a power plant which to the erudite technician would appear as the almost perfect solution of the arduous problems of high-power on giant aircraft.

The first attempt at connecting several engines to a single propeller was made by H. Coanda. In the Military Trials of 1911, he entered an airplane, the most original characteristic of which was constituted by the two 70 hp. Gnome engines on the forward end, and at either side of the fuselage. The axis of these engines was perpendicular to the direction of travel. These engines drove, through bevel gears, a four bladed propeller mounted at the nose of the machine.

In Germany, during the war, the five engined giant aircraft had their wing-engines coupled together in pairs driving a single propeller.

The Linke-Hoffman, which has four Mercedes engines driving a single propeller, has been flying for over a year and one-half. The Staaken-Friedrichshafen biplanes, also, have groups of two engines connected to a single propeller. But, even if we may disconnect certain engines by means of clutches operated by the mechanic, none of these machines are fitted with any mechanical device whereby a power element which begins to weaken will be immediately, and automatically, disconnected.

Some time ago the Italian engineer Rosatelli accomplished in a most interesting way the automatic coupling of three Fiat engines to a single propeller, but in the last six months this invention has been shrouded in silence. It is then to be presumed that the inventor's attempts have not been crowned with success, or possibly, that the economic crisis which is embarrassing our ally at the present time, has prevented the continuation of the trials.

Description of the Machine

The Louis Breguet Co. after exhaustive studies which lasted nearly three years, are, at the present moment finishing the construction of a biplane type XX, called Leviathan, which will shortly undergo its first trials. The new machine is essentially characterized by a Breguet-Bugatti engine group, equipped with a "connector-disconnector", which, in our opinion, constitutes one of the greatest improvements brought about in aeronautic construction to this day.

Wings—The biplane wing truss, which is entirely made of metal, with the exception of the wing covering, still made of cloth, is formed by a group of three wing-beams assembled on struts which are made of two inter-connected tubes, a lattice column in other words, having the maximum resistance to buckling and the minimum head resistance for a given weight. These struts are quite simple, being made up of two separate tubes connected by an appropriate trussing, which makes it possible to get equal moments of inertia about the principal axis of the section and thus to realize a consistent factor of safety throughout the different members. The middle wing-beam, as a result of the wiring system is subjected to bending stresses only.

The ribs are made up of sections formed of sheet duralumin. The struts and wires are all fastened with ball-and-socket joints, as is common practice in Germany, in order to avoid the couples introduced by fixed joints.

The wing-structure can be dismantled into three parts, the central portion and two lateral units. The central portion is secured to the fuselage, forming together with this and the landing gear, a particularly solid and homogeneous unit, thanks to the presence of diagonal struts which connect the lower ends of the inner struts to the upper longerons of the fuselage. This happy arrangement assures a high factor of safety for the entire structure.

The wings are not staggered but both upper and lower have a sweep-back of 3.5 deg. The upper wings are practically rectangular in plan view, with 795 sq. ft. of surface and are fitted with two balanced ailerons, remarkable for their short chord and relatively great span. The dihedral for both upper and lower wings is 4 deg. The lower wings have 710 sq. ft. of surface and are similar to a Blériot monoplane wing in plan view, although having a considerably higher aspect-ratio. The tail surfaces are composed of a horizontal stabilizer, part of which is fixed, and part moveable, whereby it is possible to change the incidence of the latter in flight. The main vertical surface is made in the same way. Two fins, one on either side, complete the tail assembly. The moveable parts of the horizontal and vertical surfaces, are not rodders or elevators, properly speaking. Their incidence (in reference to the horizontal surface) can be progressively varied in flight in order to give the machine its best flying angle corresponding to every variation in weight of the load carried, and (in reference to lateral drift) to compensate for drift when the machine is flying in a cross-wind. Up to now, the nose of the machine has been held to its proper course by foot pressure on the rudder bar. In heavy machines such a maneuver becomes very fatiguing to the pilot, so that this has been remedied by the use of specially adjustable surfaces.

Fuselage—The fuselage, which is of prismatic form, very fine in front, is built up of thin duralumin in rectangular frames fastened together by four main longerons of duralumin tubing. The faces of the truss thus formed are cross wired, but there is no wiring in a plane perpendicular to the axis of the fuselage. This method of construction keeps the inside of the fuselage clear and allows one to get from the engine mounting clear back to the rudder without encountering any obstacle which would necessitate crawling through, or around. The fuselage covering at the forward end is of metal little fasteners of pressed aluminum holding the corners and then U-bolts the flat surfaces.

Landing-Gear—The landing gear is particularly strong and simple. The two wheels, 69 in. in diameter are mounted in overhang, which arrangement is indispensible for large machines. They are elastically connected to the frame of the fuselage by articulated struts and sandows which have very great shock absorbing qualities. It is noteworthy that the point of contact of the wheels with the ground is ahead of a vertical passing through the horizontal axis of oscillation of the chassis. This greatly facilitates landing as at the instant of first contact a couple is introduced which tends to throw the tail down.

The rear suspension is similar to that used on earlier Breguet models and consists of a tail skid mounted on an oil pneumatic brake and slung with sandows.

Power Plant and Automatic Connector-Disconnector—The power plant, giving a total of 850 hp. at 1800 r.p.m., is composed of four Bugatti engines, each of which has eight vertical cylinders, and working independently, but mounted in pairs on two crankcases in order to save weight. All four crankshafts engage a central reduction bevel gear, placed between the two crank-cases, which is rigidly connected to the propeller-hub by means of a long shaft which passes between the cylinders of the right and left hand forward engines. The central reduction gear cuts the engine speed in half. The transmission shaft (from gear to propeller) is supported from the engine cradle by means of self aligning roller bearings. No propeller vibration is communicated to the machine. The propeller is a wooden four-blader 14 ft. 9 in. in diameter (900 r.p.m. at full power).

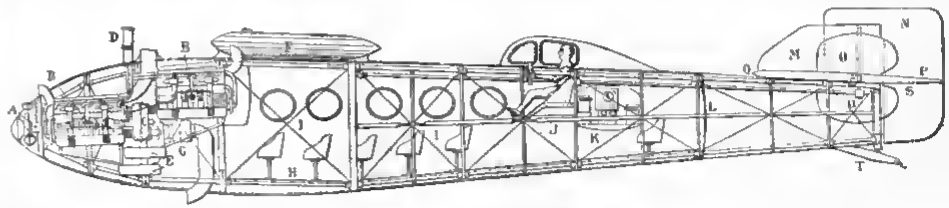
The really great progress realized in this power-plant consists in the device called the "connector-disconnector" which allows independent starting of any power element and its automatic disengagement in case of the motor couple falling off, or in case of a sudden breakdown.

The automatic disengagement is effected as follows: the crankshaft gears, or driving gears, are free to slide back and forth on the crankshaft which is fitted with long keys, and engage the central reduction gears by means of helicoidal teeth.

As soon as the couple of one engine diminishes, the helicoidal driving gear winds itself progressively out of mesh as it is free to slide along the keyway (this is similar to the operation of some automobile self starters) and the releasing of the clutch follows instantaneously upon this operation for a certain value of the motor couple. When running normally, the axial thrust on the driving gears is equalized by the tension of a spring which bears on a fixed thrust-bearing.

A special mechanism allows the mechanic, who is stationed in the engine room throughout the flight, to know at any moment the value of the couple of the engines. It is therefore easy for him to regulate the power of any individual engine.

The connection between each engine and the "connector-disconnector" is made by means of an elastic coupling formed by leather washers working between plates, the function of which is to deaden vibration and give a certain flexibility longitudinally. An automatic locking mechanism prevents any automatic disengaging to take place when unnecessary, as for example, when the pilot throttles down the whole power-plant.



General Arrangement of the Breguet Leviathan. A, Propeller Shaft; B, Engine Unit; C, Connector-Disconnector; D, Radiator; E, Oil Tank; F, Gasoline Tank; G, Turbo-Compressor; I, Passenger Cabin; J, Control Station; K, Radio Station; L, Bulkhead; M, Vertical Fin; N, Central Fin; O, Lateral Fins; P, Rudder; Q, Stabilizer; S, Elevator; T, Tail Skid.

A synchronizing device permits of a uniform firing order for all thirty-two cylinders so that the whole plant will run like a single engine, the torque of which will be remarkably even. An electric starter mounted on the central gear completes the installation and assures easy starting.

The engine-room layout is such that the mechanic has easy access to the engines, and, in the event of one engine being put out of commission he can, in flight, make minor repairs such as changing spark-plugs, replacing defective water connection, changing a valve-spring, etc.

The honeycomb radiator is of the collapsing type, that is to say as fast as the outside temperature drops, the exposed surface of the radiator is diminished, and, necessarily, the head resistance at the same time. It is placed in the upper part of the fuselage just over the "connector-disconnector". This radiator is made up of four elements which can be isolated by valves in the inlet and outlet pipes so that a damaged element may be cut out without affecting the rest of the radiator. The four elements are all alike and are interchangeable.

The fuel is carried in four tanks and is of sufficient quantity to run the engines for seven hours at full power. Each tank, made of duralumin, is so built that its upper portion serves as pressure feeder-tank as well.

The four engines are fed by two pumps which are self regulating, the supply of either one being sufficient to feed all four engines.

Pilots' Cockpit—The pilots' cockpit is placed behind the wing-structure and approximately half way between the latter and the tail surfaces. The chief pilot is helped out by an assistant pilot, and the two seats are side by side, the visibility is perfect; the pilots can see the wheels of the landing gear.

Airplane Controls—The dual control is realized very simply

* Translated by S. S. Pierce from *L' Aerophile* Feb. 1-15, 1921.

† X.—First Transatlantic, one 700 hp. Fiat engine. Y.—Caudron type C-25, three hp. Salmson engines. Translator's note.

by the lateral movement of a wheel mounted on a fixed central column which can be placed in two positions in order to pass freely from the right hand pilot to the left hand pilot or vice-versa. In view of the amount of surfaces of the control surfaces and stabilizing surfaces, it has not been possible, as in small or medium-sized machines, to connect the control surfaces directly to stick and rudder-bar It has been found necessary to interpose reduction gears, in the shape of worms and sectors.

The rotation of the wheel is transmitted through a Galle chain system and torsion tubes to toothed sectors driving the ailerons. The differential operation of the ailerons is accomplished by an arrangement similar to the differential case of an automobile. The fore-and-aft motion of the wheel is transmitted through connecting rods and tubes to toothed sectors engaging the worms of the elevator.

The rudder sector is operated by foot-bars similar to those used on the regular Breguet models.

In this connection a significant fact may be noted, namely, that there is not a single cable used in the entire control system, cables being subject to excessive wear and require frequent adjustment. Large roller bearings and strong universal joints together with this mechanical system make a reliable outfit which can not get out of adjustment, prevents vibration in the moveable surfaces, and annuls all torsion stresses in connection with the longerons.

We have already said about the tail surfaces that outside of the regular rudder and elevators, moveable parts are provided on the fixed surfaces for the purpose of varying their incidences and so render the piloting of the machine as easy as possible. Two concentric wheels, placed behind the pilot effect these changes in incidence.

Engine Controls—The throttle lever is placed on the hub of the wheel which operates the ailerons and which, by rotating a shaft, controls the eight carburetors of the power plant simultaneously The fore and aft motion of this same shaft operates the ignition contact and the locking of the "connector-disconnector" A special device prevents cutting out the ignition until the throttle is partially closed.

Individual throttles and ignition-switches can be operated by the mechanic in the engine-room, who can thus regulate the power of the different engines, as necessity arises, according to their output as indicated by the various tachometers, couple (torque) indicators, thermostats, water and oil gauges.

Possible Armament—The Leviathan has been designed to fulfill various requirements of war and commercial aviation. When used as a military machine the useful load will be 4400 lb. Bombs of various weights would be carried according to the nature of the bombing raid undertaken Thus, either twenty 220-lb bombs, or, ten 440-lb bombs, or, ten 220-lb. bombs and twenty 110-lb bombs, or, four 1100-lb bombs, or, two 2200-lb bombs.

The defensive armament consists of six machine guns disposed as follows — two in front, each of these being placed in a turret, one on either side of the fuselage The two after guns are also placed in turrets on either side. The last two on a twin-mount fire aft under the fuselage.

Equipped as a Passenger Carrier—For commercial use the machine is fitted with a cabin, having two rows of chairs with an aisle between, capable of carrying a considerable number of passengers. Port-holes on top and at the sides give plenty of light Access to the passenger cabin is through a trap-door in the bottom of the fuselage.

Characteristics		
Span	68 50	ft.
Length	49 00	"
Gap	6 83	"
Total height	19 40	"
Area, upper wings	736	sq. ft.
" lower wings	710	" "
" total (supporting)	1306	" "
" horizontal tail surface	68	" "
" stabilizer	87 6	" "
" main vertical surface	13	" "
" rudder	26 25	" "
" auxiliary fins	15 50	" "
Weight of structure	2200	lb.
" " power plant	3520	"
" " empty	5720	"
" " useful load	4880	"
" " fuel	3300	"
" " fully loaded	19,570	"
Loading per square foot	14 2	
horsepower	16 3	"
Performance		
Ground speed	118	m.p.h.
Average speed at 6500 ft	108	
Economical speed	100	
Ceiling (estimated)	14,400	ft.
Climb in 6500 ft 18	20	min
Getaway run	1000	ft.
Landing run	650	ft.
Radius of action (economical speed)	950	miles
Duration of flight (economical speed)	10	hr

The Leviathan will be tried out in a few weeks, and we have great hopes for the result. As a matter of fact it is, at the present time, the only French machine which can compete with the German giant aircraft. Personally, and knowing full well that it is very risky to predict anything, even in the immediate future, I have no doubt of success, and we may be sure that this machine marks a considerable progress in the history of aviation.

Speed Calculations

It seems remarkable how few pilots understand the correct method of figuring air speed for the close circuit. The simplest method is to lay out a measured distance, preferably along a road or other visible straight line, to facilitate straight steering, the ends being of course marked by suitable pylons. Choose a day if possible when the direction of the wind is approximately in line with the course in either direction. It makes an difference what the wind speed is so long as it is fairly constant and not more then 10 or 15 deg out of line, (although it must be granted that a high windspeed usually produces correspondingly large variations of speed and direction.) Usually the steadiest conditions may be found at sunrise or just after sunset

The airplane or airship to be tested is given a flying start from either end, is steered straight between the terminating points, then circled around and steered back again in the same way all at a constant altitude. The time for a straight passage in each direction is independently recorded Then the speed is figured separately for each direction and finally the two speeds averaged. The same procedure should be repeated as often as necessary to get a good check or average.

It is not correct to divide the round trip distance by the sum of the running times as can be readily seen from the following illustration. Suppose the air speed of the ship to be 90 m.p.h., although we do not yet know what it is. Suppose we run it over a course of one mile in each direction. Let us further suppose that the speed of the wind is 30 m.p.h in line with the course. Then the time measured with the wind is 2/3 min, and the time against the wind 2 min. Dividing the total distance of 2 miles by the total time of 2 2/3 min. and multiplying by 60 to get it in miles per hour, we have as a result 45 m.p.h, which of course is not correct, as we assumed the speed of the plane to be 90. Now compare this with the other method.

The speed *with the wind* for the same conditions is one mile divided by 2/3 min and multiplied by 60, which gives 90 m.p.h. The speed *against the wind* is one mile divided by 2 min and multiplied by 60, which gives 30 m.p.h. Averaging the two results we get 60 m.p.h, which is the correct solution. This figures out absolutely the same for any constant speed of wind up to the air-speed of the ship, as long as the wind is approximately in line with the course The same method may be made to take care of a wind from any direction by making out the course in the form of an equilateral triangle. The speed on each leg is then figured seperately as before and the three speeds average together

The latter method, although mathematically correct, is seldom used on account of the practical complications and the fact that variations in the wind and altitude introduce areas from the outside

Huff-Daland Biplane at Boiling Field

A Huff-Daland twin-engined commercial airplane has arrived at Bolling Field, Washington, D. C, recently and was set up there for some experimental tests. The machine has a maximum span of 37 ft., and overall length of 23 ft., and an overall height of 8 ft. 6 in. Its weight loaded is 2,800 lb, which includes fuel for two hours' flight and five men including the pilot. The weight empty is approximately 1,750 lb The power plant consists of two 100 hp Anzani air-cooled radial engines, which drive tractor propellers The gasoline capacity is 45 gal, which is sufficient for two hours' flying The maximum speed is between 90 and 100 m.p.h at full throttle and the take-off occurs in about 8 sec The overall safety factor of the machine is about 6.

This new commercial airplane is a product of the Huff, Daland Co., Inc., of Ogdensburg, N. Y This firm has already

Huff-Daland HD-1B Twin-Engined Commercial Airplane

manufactured an Army training airplane, called Model HD-4, which is fitted with the 140 hp air-cooled radial 9-cyl. Lawrance engine The Air Service let a contract for three experimental machines of this type and, delivery having been made, the ships were sand and flight tested and accepted.

C M. Devitalis is the pilot of the plane which arrived in Washington This particular plane is being tested with reference to picking up materials during flight from the ground in order to work out patents that are pending for the purpose of accomplishing this feat. The plane has a high parasite resistance when being landed and consequently rolls but a short distance on landing

Underwriters for National Air Code

Among the questions which have been submitted by commercial organizations to the Chamber of Commerce of the United States of America, Washington, D. C., for consideration at the ninth annual meeting of that body to be held at Atlantic City from April 27 to 29, there is the following —

Aeronautical Code

The National Aircraft Underwriters Association submits for consideration the following resolution

"Whereas the prevailing economic situation demands a reduction of governmental expenditures, an increase of business activity, and full opportunity for the development of our transportation facilities; and

"Whereas the military and naval authorities concede that a strong aerial force is one of the surest and most economical means of national security if there be built up a commercial aeronautical industry which will make available a reserve in production facilities and trained personnel; and

"Whereas the development of aerial navigation as a means of transportation of cargo and passengers and as a civilian reserve to be drawn on in any national emergency is being retarded by the lack of regulatory federal legislation; and

"Whereas public safety demands that the rights, duties, and liabilities of aircraft owners and operators shall be definitely and authoritatively determined. Therefore be it

"*Resolved* by the Chamber of Commerce of the United States of America, That Congress be urged to consider at once the aeronautical situation, and that it be requested to prepare and pass legislation embodying an aerial code and providing the necessary machinery for its enforcement, and be it further

"*Resolved*, That copies of the resolution be submitted to the presiding officers of the Senate and House of Representatives and also to the members of the following committees in both chambers: Military, Naval, Post Offices and Post Roads, Ways and Means, Finance, Appropriations and Judiciary."

Incorporation of Airliner Engineering Co.

The Airliner Engineering Co., recently incorporated, has established its factory at Amityville, Long Island, N. Y., the company being fortunate enough to take over a well equipped airplane factory, which had been in operation for several years. This facilitated the ready construction of a large twin-engine passenger machine of a novel type, which promises to mark an important step forward in aircraft construction. One of the most interesting points about the machine is the placing of the two engines inside of one large fuselage, thus eliminating the parasitic resistance always found in the twin engine machines. It is expected that on two Liberty motors it will be possible to carry 25 passengers with a range of 800 or 900 miles.

The fuselage is of lifting section and the interplane trussing has been reduced to a minimum by the use of a thick wing section. Ample provision has been made for passenger seating, the peculiar construction of the fuselage allowing this without creating parasite resistance.

Capt Charles Cox

G. C. T. Remington

The pilot and the mechanic occupy excellent positions for vision and ready access to both engines. Ready access to both engines will be a valuable feature of the machine.

The chief engineer of the company is employing in the design of the plane the firm of Alexander Klemin & Associates in a consulting capacity; wind tunnel tests and careful analysis being carried out by them as an additional check on the engineering of the company.

The construction was begun on Jan 15, 1921, and is well along The workmanship of the plane is all the very best. The company expects to fly the machine all over the country for demonstration purpose.

The president and general manager of the company is George C. T. Remington, a Yale man, who enlisted in the Navy during the War, and a year after the conclusion of the war re-enlisted in the Aviation Section of the Navy for the purpose of obtaining aviation experience. Mr Remington has had considerable flying experience on a large number of types of sea going craft and also on land planes. His early training was one of the general scientific and mathematical character. Mr Remington is now on extended furlough from the Navy and has taken active charge of the corporation as president and general manager

Capt. L. Charles Cox is acting as vice-president, treasurer and pilot. Captain Cox has seen considerable service in the Royal Flying Corps and has many German planes to his credit. He has flown a large number of types in this country, including the twin-engined Lawson air liner among others. He has the reputation of a skilful and very careful pilot with a good long flying record to his credit.

The chief engineer is Vincent J. Burnelli, who has had many years' experience in the design and construction of land and sea planes, having been associated with the Lawson Aircraft Co., Nebraska Aircraft Corp., and other concerns. The conception of the plane now being built by the Airliner Engineering Company, Inc., is due to Mr Burnelli and is the result of many years' study and observation in airplane construction.

The assistant chief engineer is Wilhem J. Sullivan, and John Carissi is construction supervisor.

Staff of the Engineering Division, Air Service

In the group picture on this page there are shown all the officers who make up the staff of the Engineering Division, Air Service, at McCook Field, which is in charge of Maj. Thurman H. Bane. The officers are, from left to right —

Top Row—1st Lt. M. S. Fairchild, 2nd Lt. Leigh Wade, 2nd Lt. C. L. Morse, 1st Lt. E. W. Drehman, 2nd Lt. R. G. Schmidt, 1st Lt. R. B. Vaughn, 1st Lt. J. A. Macready, 2nd Lt. M. H. Redman, 2nd Lt. A. F. Hegenberger, 2nd Lt. C. N. Monteith, 1st Lt. Kellogg Sloan, 1st Lt. H. R. Harris, 2nd Lt. G. W. Haskins, Capt. A. W. Brock, 1st Lt. H. A. Sutton, Capt. G. C. Kenney, Capt. W. T. Gorton, 1st Lt. H. L. Campbell.

Center Row— Capt. H. W. Fleckinger, Capt. R. H. Fleet, Maj. C. W. Howard, Maj. H. S. Martin, Maj. C. C. Benedict, Maj. F. D. Lackland, Maj. C. H. Wash, Maj. G. E. A. Hallett,

The Staff of the Engineering Division, Air Service at McCook Field

Maj. Thurman H. Bane, Maj. L. W. McIntosh, Maj. A. H. Hobley, Maj. F. L. Hoffman, Maj. N. J. Boots, Maj. W. L. Clay, Maj. E. L. Napier, Maj. F. H. Coleman, Maj. H. C. Davidson, Maj. W. H. Henry.

Front Row—2nd Lt. D. L. Bruner, 2nd Lt. C. W. Pyle, 2nd Lt. O. G. Kelly, 2nd Lt. R. D. Biggs, 1st Lt. C. W. Connell, 1st Lt. F. D. Tyndall, 1st Lt. T. E. Tillinghast, 1st Lt. J. P. VanZandt, 1st Lt. E. E. Aldrin, 2nd Lt. W. R. Fletcher, 1st Lt. E. H. Nelson, 2nd Lt. Bayard Johnson, 2nd Lt. A. C. Foulk, 2nd Lt. K. G. Fraser, Lieut. S. H. Wooster, U. S. N., 2nd Lt. G. W. Polk, 2nd Lt. F. W. Niedermeyer.

Aeromarine Co. Opens Flying-Boat School

During the war the Navy Department established a school for carpenter's mechanics and used the factory of the Aeromarine Plane and Motor Co. as a class room for government workers. Navy pilots were sent there for construction work and training and piloting for smaller types of seaplanes. A new flying school will be opened this spring, but instead of being trained for war, students will be trained to take their place in commercial aviation.

C. F. Redden, president of the Aeromarine Engineering and Sales Co., said that since the Navy arranged with his concern to distribute HS-2 Navy Patrol flying boats which the government has released with the idea of developing commercial flying, many inquiries have been received from sportsmen and others concerning instruction for pilots.

Those who wish to learn flying want the finest instructors, and the assurances that the planes used are of the best. Before the war Aeromarine was a well-known name in aviation—even then Aeromarine products had proven their worth. Today the Aeromarine flying boats are the finest that skill and excellent material can produce. Instructors at the flying school will be ex-army and navy officers whose records speak for themselves. Students at the Aeromarine school will receive instructions in both land and water flying craft, particularly straight flying and navigation necessary in passenger carrying machines. There will be a lecture course in addition to the actual flying, and this will cover the general principles of flying—the manufacture, assembly and rigging of machines, and also of motors. Students will have the opportunity of observing flying boats being built for commercial purposes in the same factory where they are undergoing a course of training. Rest rooms and class rooms are being provided on the factory grounds.

Flying instruction will consist of five hundred minutes flying time, all of which will be in machines equipped with dual control so that students will be taught to fly correctly under dual instruction.

The plant of the Aeromarine Plane and Motor Company includes 66 acres with sixteen buildings, a club house, restaurant, engine plant, assembly building, a seaplane station and flying field for land machines. This is the only flying school in the East where pilots can receive both land and water instruction at the same location.

"It is the intention of the Aeromarine Co.," said Mr. Redden, "to make this school the most elaborately equipped special flying school in the country. We realize that we are faced in the future with a possible lack of trained pilots. Many of the pilots who served in the Air Service during the war have returned to civil life. This affords a remarkable opportunity for the thinking man to prepare himself to take an active part in flying—the newest, quickest and by far the most comfortable mode of transportation."

Merger of Two Montreal Aircraft Firms

The early spring weather finds flying already under way in Montreal. During the winter arrangements for a merger of the two pioneer flying organizations, the R. & W. Air Service and the Canadian Aerial Services, Ltd., have been completed. The amalgamated concerns will operate under the name of Canadian Aerial Services, Ltd., from the public customs air port at Lazard, near Cartierville, Island of Montreal.

This air port is very nicely situated on the Canadian National Railway, main Ottawa Line, and may be reached from the center of the city by train in twenty minutes, and by street car in half an hour. It is very well equipped with an up-to-date workshop and a large Bessonenn hangar of the Air Force regulation type, materially strengthened to stand the rigor of the Canadian winters.

The staff of pilots includes Adelard Raymond, H. D. Wilshire, R. B. Deville, J. H. St. Martin and L. R. Charron, all of whom have had considerable experience in commercial flying. A. E. Walford, the secretary-treasurer, has made an extensive study of cost accounting, as related to aviation, and looks after the financial interests of the company at its offices in the Lake of the Woods Building.

The company at present owns six machines, and expects in a very short time to obtain another one for operation. Their maintenance is under the supervision of R. W. Warner, in charge of engine repairs, and A. B. Smith in charge of rigging.

Contracts are now being closed for exhibition flying, aerial advertising, aerial photography and flying instruction, and because of an efficient organization with considerable experience behind it, satisfaction and reliability are assured to all those making use of its service.

THE AIRCRAFT SERVICE DIRECTORY

Where to Procure Equipment and Services

AIRPLANES
ENGINES
PARTS

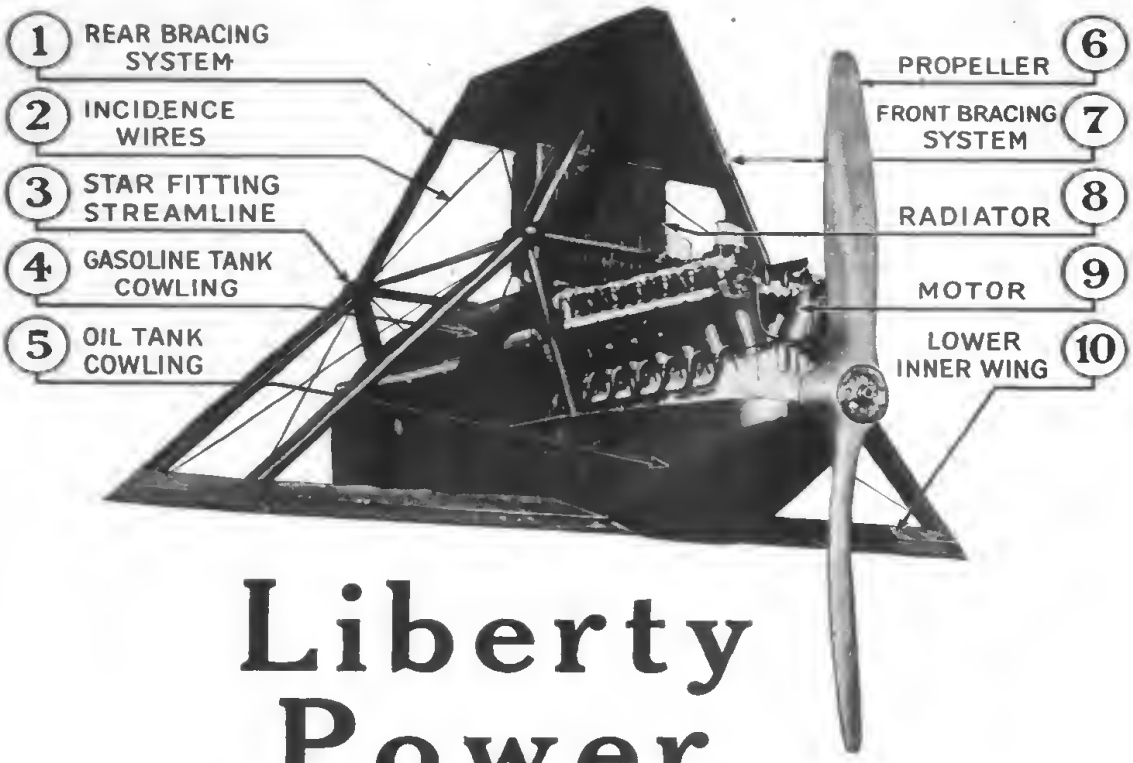
ACCESSORIES
TRAINING FOR
PILOT OR MECHANIC

EXHIBITION WORK
AERIAL ADVERTISING
PASSENGER CARRYING

PARCEL CARRYING
AERIAL PHOTOGRAPHY
AND MAPPING

THE AIRCRAFT SERVICE DIRECTORY *Continued*

INDEX TO ADVERTISERS

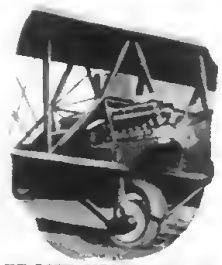


Liberty Power

IN war-time it is imperative that all fighting planes on which the Nation depends for defense, should be American built throughout.

In time of peace it is no less important that every detail in the construction of commercial planes should be of domestic manufacture--if the owner is to be spared the penalty of long delays in repair and replacement service.

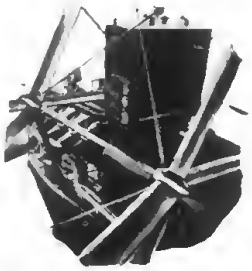
The two liberty 12-cylinder motors which power Glenn L. Martin airplanes are straight American from spark plug to bed-bolt. No aeronautical engine of the same horse power has ever approached the record of the All-American 400 horse power Liberty motor for efficiency and reliability.



FRONT VIEW SHOWING RELATION TO UNDERBODY

The power plant of a Martin plane represents the latest and best word in American engineering, and is typical of the quality which goes to make up every individual part of a Glenn L. Martin plane.

TRADE MARK



REAR VIEW OF ENGINE AND BRACING SYSTEM

THE GLENN L. MARTIN COMPANY

CLEVELAND

Member of Manufacturers Aircraft Association